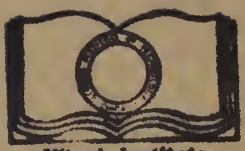
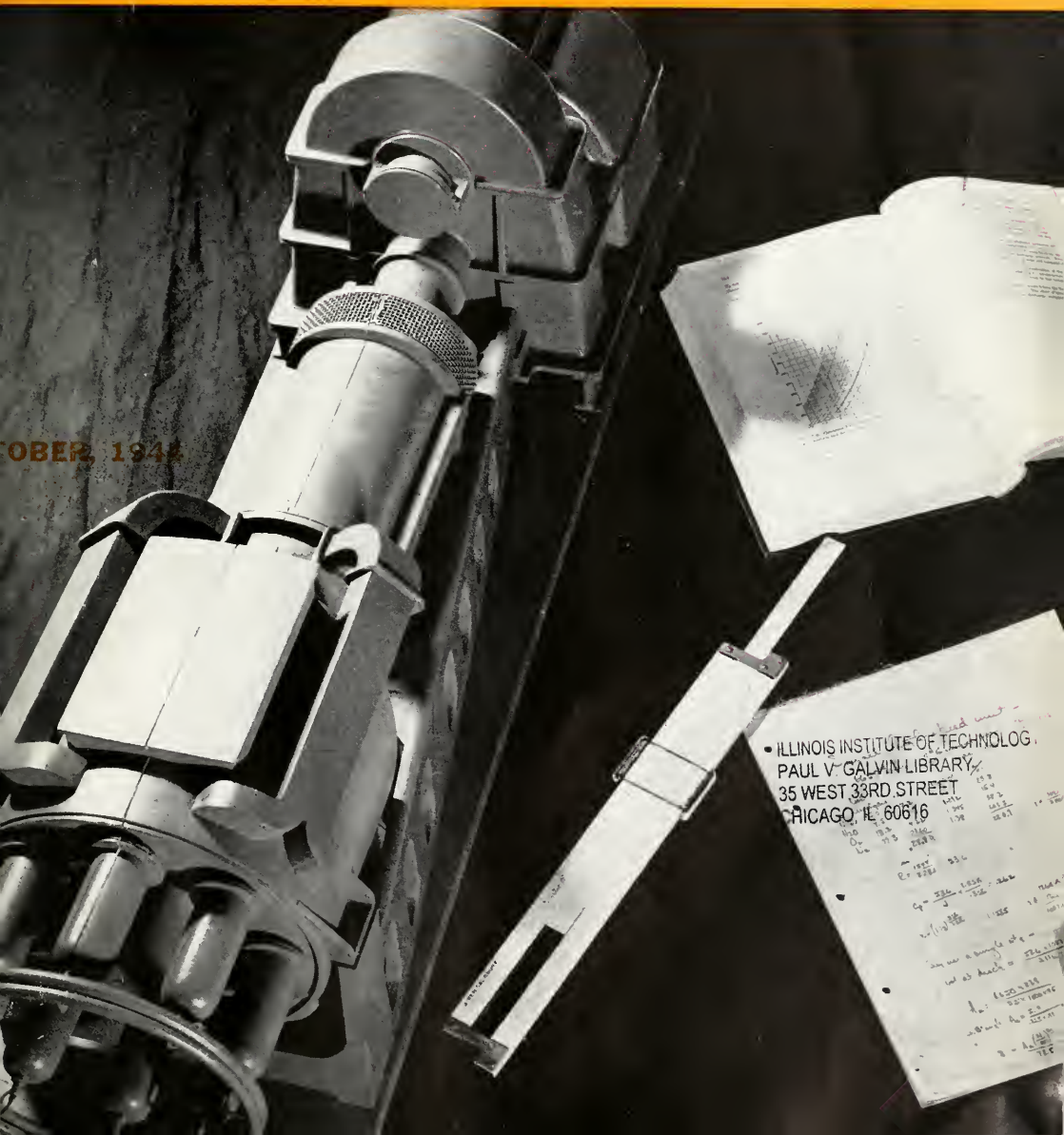


ILLINOIS TECH ENGINEER

AND ALUMNUS



Through a Glass...Darkly

Today new materials eclipse many of the old familiar ones that once were thought indispensable.

Synthetic rubbers, for example, replace natural rubber in scores of familiar products. Yet the future of synthetic rubbers in many important applications—tires, for example—is still a matter that only can be seen now "as through a glass darkly." Success depends not only on progress in synthetics themselves but also on the development of new and better processing materials.

A long step forward was taken when Furnace Type Carbon Black, a combustion product of natural gas, was shown to reduce greatly the tendency of Buna S rubber to generate destructive heat in heavy-duty tires. Lower heat generation means greater strength and longer life.

To help meet the great and growing demand for this type of black, Witco has erected in double-quick time a large new plant at Sunray, Texas, and put it into full production. CONTINEX FURNACE TYPE CARBON BLACKS, produced in this new plant, are today stepping up the speed and increasing the safety of many types of mobile military equipment by helping to improve the quality and stamina of the tires on which they ride.

Meeting demands for furnace as well as other carbon blacks is but one of the ways Witco serves the producers of rubber, paints, printing inks and other products. If you use chemicals, pigments, asphalt products or allied materials we invite you to submit your problems to our research laboratory and technical staff.

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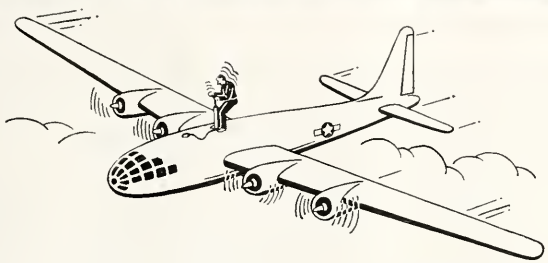
G-E Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

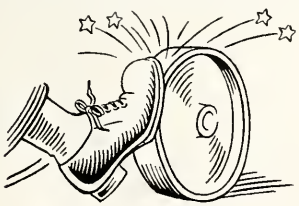


NEW PRESSURIZED CABINS

AN ALERT crew is needed to give any airplane the edge on the enemy. That's why the new B-29 Superfortresses have pressurized cabins that enable airmen to relax in relative comfort on unusually long flights between their base and the target.

G-E turbosuperchargers keep crew members warm and provide them with sufficient oxygen even at very high altitudes, eliminating the use of oxygen masks or electric flying suits except during the brief period of the actual bombing run. Consequently airmen feel better, react faster, when their objective is in sight and enemy opposition is the toughest.

The turbosuperchargers which maintain near normal atmospheric conditions in the cabin of the B-29 were originally developed by G.E. to provide compressed air for plane engines. On the B-29 there are two turbosuperchargers to supply each of the four engines. Two of the turbosuperchargers not only supply the engines, but also feed air at regulated temperatures to the sealed cabins.



FAST BRAKE

VERY often it's as important to stop a motor in a hurry as it is to get it going in the first place. One General Electric engineer has developed a brake that can stop a one-eighth-hp, 16,000-rpm motor in less than six turns. That's equivalent to stopping a mile-a-minute automobile in 2.73 feet.

Magnetism keeps the brake from the whirling rotor when the motor is running. When the power is turned off, a cork shoe brings the rotor to a standstill. The new brake has comparatively few parts. It was developed for use in the operation of equipment for the armed forces.

GROWING PLASTICS

SURROUNDED by foam, G.E. plastics laboratory men pronounce their newest product a huge success. A quart of molasses-like mixture which they have developed expands enough to fill a seven or eight gallon receptacle about ten minutes after it is prepared.

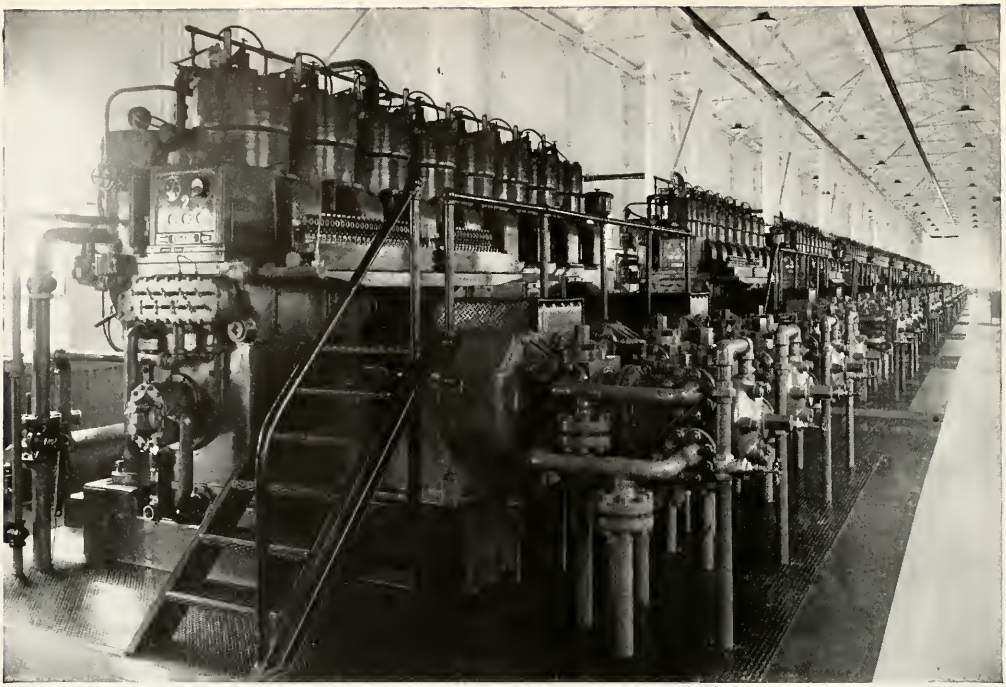
This foam has other advantages. Self-rising and self-curing, it is lighter than rock wool, glass, or cork; its heat conductivity is lower than that of any of the three. After the war it promises to have many applications, especially where insulation is required. *General Electric Company, Schenectady, N. Y.*

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, every weekday 6:45 p.m. EWT, CBS.

The best investment in the world is in this country's future. Keep all the Bonds You Buy.

GENERAL ELECTRIC

963-94



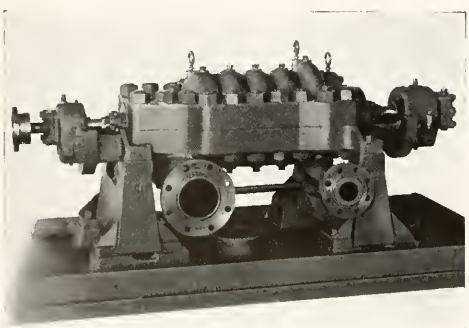
Eleven 8-cylinder 800 BHP CLARK "Angles" in La Gloria Corporation Recycling Plant, Falfurrias, Texas.

Achievements in the Field

PACIFIC PUMP WORKS

Boiler Feed Pumps in oil refineries, power houses and utility field must be tough and efficient. For this purpose, Pacific manufactures a complete line of centrifugal pumps in types and sizes to meet all flow conditions—High Pressure multi-stage pumps, capacities up to 1500 G.P.M. Solid forged-steel case multi-stage pumps for higher pressures—single and two-stage pumps for lower pressures.

Illustrated below is one of the many types giving unsurpassed service in this important field.



Pacific Type JBMB—Size 3-inch precision engineered 5-stage Boiler Feed Water Pump No. 7138, installed in a large Western oil refinery.

CLARK BROS. CO., INC.

This battery of eleven 8-cylinder, 800 BHP CLARK "Angles" in the recycling plant of the La Gloria Corporation, near Falfurrias, Texas, is one of the largest compressor plants ever placed in operation. The daily capacity is 185,000,000 cu. ft. of gas.

The plant is a unitization project, handling the recycling operations of the entire La Gloria Field for the four major oil companies which control its production. The compressors operate at 1500 lbs. suction pressure and return the gas to two separate sands at discharge pressures of 2700 lbs. and 3100 lbs., respectively.

Clark Bros. Co., Inc. and Pacific Pump Works are individually operating members of the Dresser Industries

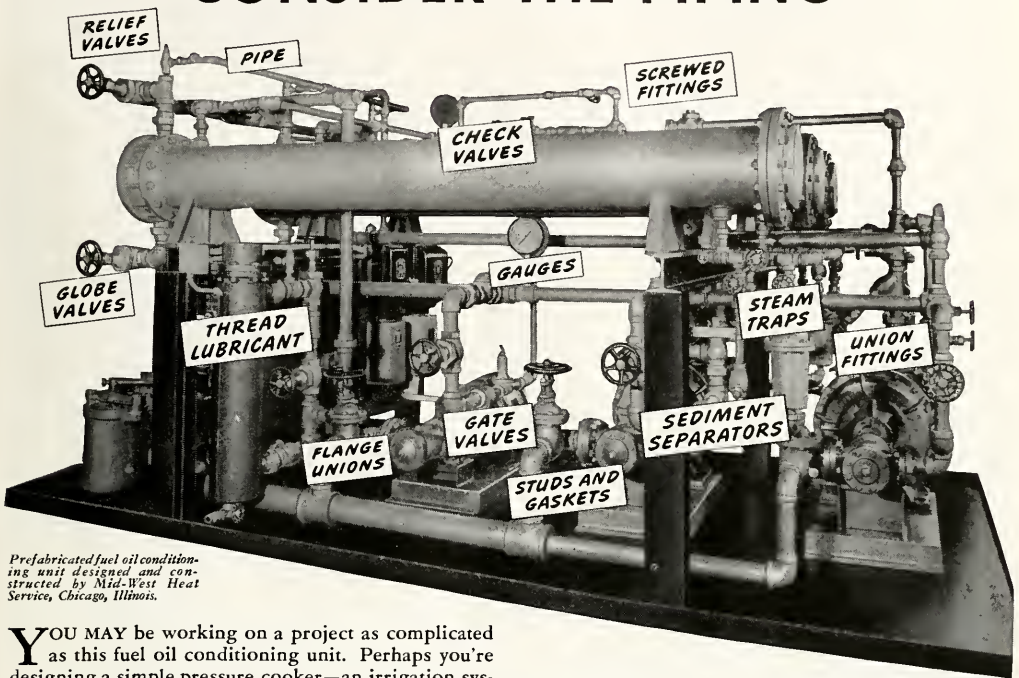
"Two of the Dresser Industries"

CLARK BROS. CO., INC.
OLEAN, NEW YORK

PACIFIC PUMP WORKS
HUNTINGTON PARK, CALIFORNIA

NEW YORK, NEW YORK
HOUSTON, TEXAS
TULSA, OKLAHOMA
CHICAGO, ILLINOIS
BOSTON, MASSACHUSETTS
HUNTINGTON PARK, CALIFORNIA

ON PROJECTS YOU ARE PLANNING CONSIDER THE PIPING



Prefabricated fuel oil conditioning unit designed and constructed by Mid-West Heat Service, Chicago, Illinois.

YOU MAY be working on a project as complicated as this fuel oil conditioning unit. Perhaps you're designing a simple pressure cooker—an irrigation system—a hydro-electric plant—or any one of a thousand other engineering projects. Whatever the problem, they all have this in common: It takes piping to make them work.

When you make a piping layout, remember that it will have to be translated into solid metal—that the proper kind of valves will have to be installed to meet the service requirements—that fittings and bends—traps and check valves, etc.—must be installed at proper points in the line.

The parts that make up any piping system are many, but it will interest you to know that everything in the complete system is included in the Crane line.

By specifying Crane piping materials, you are assured that a single source will save valuable time all down the line. You are also assured that all parts will fit, providing simpler assembly. Long, satisfactory operation results in the high quality which characterizes piping equipment carrying the name Crane.

CRANE CO., 836 S. Michigan Ave., Chicago, Ill.

HERE'S ENGINEERING DATA TO HELP YOU

Crane engineers have prepared a number of important books and treatises on piping equipment and piping systems. These include the Crane Catalog, *listing more than 48,000 different piping items and containing valuable engineering data*—Piping Pointers Manual, *packed with information on piping installation and maintenance*—Flow of Fluids *and* Combating Corrosion, *two technical papers of value to anyone laying out pipe lines.*

On file for reference in Engineering Library

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

BRANCHES AND WHOLESALERS IN ALL INDUSTRIAL AREAS

Some Suggestions About Your Future Career

Every young man with a job to do now—whether it is training for the services, or actually serving. as millions of you are—looks forward to the day when he can begin his career.

There are going to be many exciting things to do.

From what we see ahead for aluminum, may we venture a few suggestions?

You can learn a lot about the progressiveness of a future employer by finding out what he is doing about using aluminum in his business. For instance . . .

If you see a lot of aluminum on a new product, that's a good line for you to sell.

If you see a lot of aluminum used in the shop to make things light and easy to handle, that's a good company to be with.

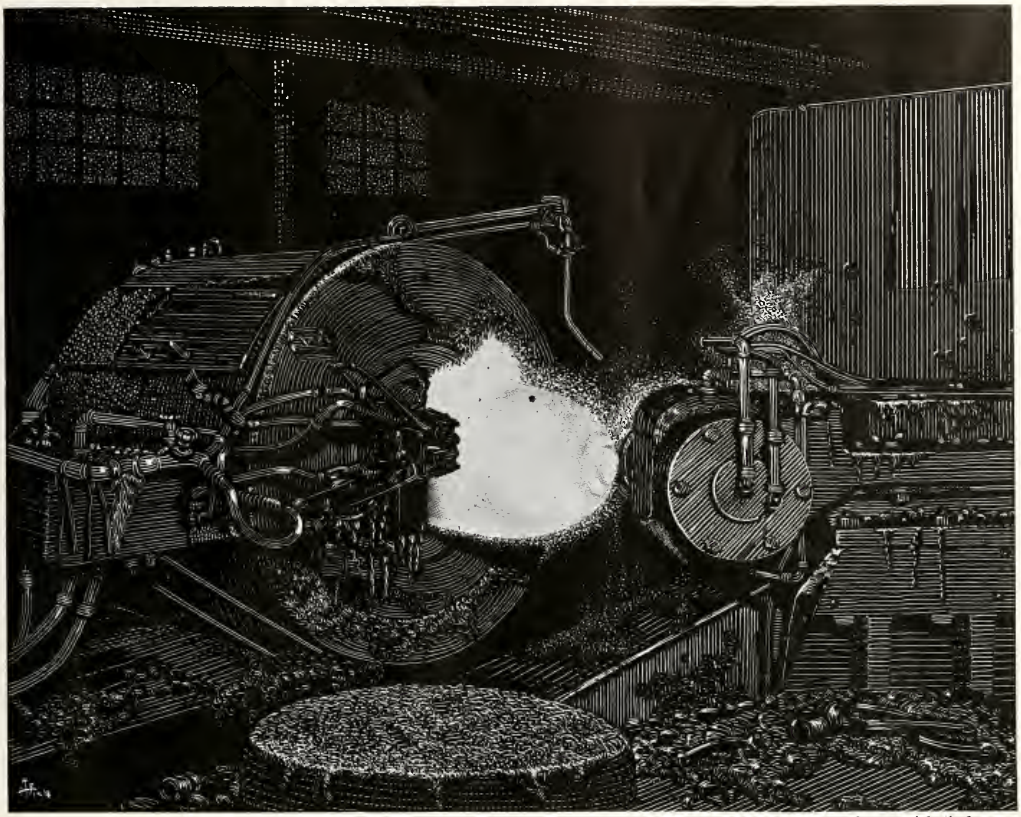
If you see a chance to make anything, or sell anything, or work with anything made of aluminum, you're going to be way out in front.

This is how we see it at Alcoa . . . the first name in Aluminum.

A PARENTHETICAL ASIDE: FROM THE AUTOBIOGRAPHY OF

ALCOA ALUMINUM

• This message is printed by Aluminum Company of America to help people to understand *what we do* and *what sort of men* make aluminum grow in usefulness.



Courtesy of Scaife Company

Birth of a "blitz-bundle"...

Here's how the metal nose of an aerial bomb is formed. A white-hot metal tube, whirling rapidly in a chuck, is brought into contact with a spinning roller. Remotely-controlled movement of this forming roller gradually molds the tube-end into the required rounded contour.

Throughout this forming operation, the tube must be held at uniform temperature — high enough to keep the metal in a plastic condition. Ordinarily, the mass of metal in the chuck tends to draw heat away from the bomb. However, by using Airco oxy-acetylene flame torches for supplementary heating, the spinning bomb is kept at a high, constant temperature, which facilitates forming and helps assure uniform wall thickness in the business end of the bomb.

This is only one of many ways in which the oxyacetylene flame is speeding wartime metal-working. It also shape cuts steel, cleans it, softens it, hardens its wearing surfaces, and welds it and other metals into strong, one-piece parts. Teamed with the electric arc this versatile "tool" has blazed new short-cuts in metal fabrication . . . short-cuts that are pointing the way to better, stronger metal products for peacetime use.

If you would like to receive our informative publication, "Airco in the News," we shall be glad to send a free copy. Write to Mr. G. Van Alstyne, Dept. C. P., Air Reduction, 60 East 42nd Street, New York 17, N.Y.

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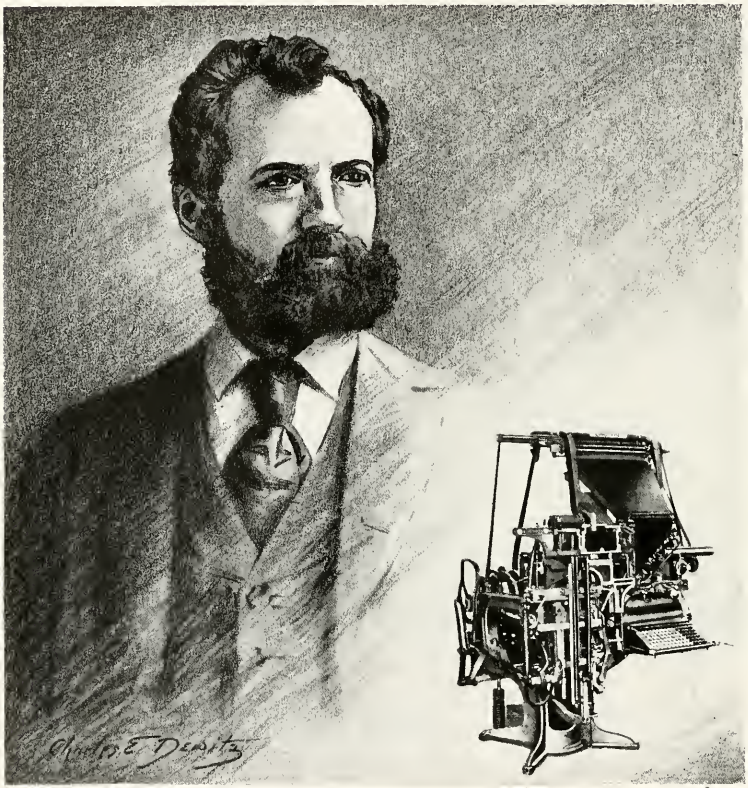
OXYGEN, ACETYLENE AND OTHER ATMOSPHERIC GASES • GAS WELDING AND CUTTING APPARATUS • CALCIUM CARBIDE ARC WELDING MACHINES AND SUPPLIES • CARBON DIOXIDE • "DRY ICE" • ANAESTHETIC AND THERAPEUTIC GASES AND APPARATUS

OTTMAR MERGENTHALER—1854-1899

Inventor of the Linotype



Unwilling to bear the yoke of Prussian militarism in southern Germany, Otto Mergenthaler fled in 1872 to America where there was a mighty impetus to great and high endeavors in every field of thought and action. Here the inventive genius of young Mergenthaler was unfolded. He had been a skilled watchmaker and it was his precision in measurement to the utmost nicety with unfailing accuracy which enabled him to create the exacting mechanism of the linotype invention.

Today the most intensive and inventive might in the history of invention is consecrated to freedom's struggle against the dark forces entrenched in the very place which Otto Mergenthaler chose to leave to come to this new world which gave him unfettered outlet to his inventive genius. This spirit of freedom is the assurance of "Victory in this global conflict so that all humankind may enjoy freedom, security and equality."

Contributors

William Bachrach is coordinator of Engineering Science and Management War Training Program.

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Carroll W. Lufcy is research assistant in the physics department.

John J. Schommer is professor of industrial chemistry, director of athletics, and director of placement.

Russell J. Tinkham is associate physicist at the Armour Research Foundation.

The cover picture shows model of the **General Electric Gas Turbine.** Courtesy of J. Kenneth Salisbury, Mechanical Engineering Magazine and the General Electric Company.

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EDUCATION FOR VETERANS

By

CHARLES AUSTIN TIBBALS

In 1939-40 the educational world in America was concerning itself with the question of "Education in National Defense", and acting promptly and effectively, with Illinois Institute of Technology among the leaders. After December 7, 1941, it was "Education and the War", and I.I.T. went "all out" for educational service to the nation, for Army, Navy, and Industry, and is still holding an honorable position among the leaders in the educational fighting of the war.

Now, with the war drawing to its climax and approaching its victorious end, I.I.T. is instituting a plan for post-war education, which will involve, for more than five years, a tremendous program of education for veterans discharged from the Armed Services of the nation. Besides the "G. I. Bill of Rights", under which nearly all veterans will be eligible for educational benefits, there are other laws benefiting veterans with service-incurred or service-aggravated disabilities. Our Government has made generous provision for the young men and women whose plans for education or training were interrupted by the call to Service. It becomes the obligation and the privilege of American education to furnish the veteran with sound, inspiring, and probably, accelerated educational programs, at the same time co-operating with him in the making of the drastic readjustments incident to his return to civil life.

All of the benefits accruing to the veteran under the "G. I. Bill" (Public Law 346—78th Congress) can only be discerned by a study of the entire contents of the bill. That portion of the bill which applies to education and training can be summarized rather briefly:

(1) *Who is entitled to the benefits of the "G. I. Bill"?*
Any man or woman who "served in the active military or naval service on or after September 16, 1940, and prior to the termination of the present war"; provided (a) that he or she shall have a discharge other than dishonorable, (b) that the time of service was 90 days or more, and (c) that the person's "education or training was impeded, delayed, interrupted, or interfered with by reason of his entrance into the Service". If the person was not over 25 years old when he entered the Service, it is assumed that his education was interrupted.

(2) *What time period is allowed the veteran for education or training?*
If his term of service was 90 days or more*, he is entitled to one year of education at Government expense (12 months, not an ordinary "academic year"). If his service was more than 90 days, the year is increased by the *total time* of his service before his discharge. Thus, if he served a total of 11 months, and was honorably discharged, the law entitles him to one year, plus 11 months, or 23 months of education. This is more than two academic years, or about five semesters in college.

(3) *What are the financial benefits?*
Every veteran eligible for education under the bill will receive college expense, covering tuition, fees, books, and necessary supplies up to $500 for an "ordinary school year" (we believe that this means two semesters or three quarters), and this allowance continues for the entire period of education to which his time of service entitles him. In addition the veteran will receive, while in a full-time educational program, a subsistence allowance of $50.00 a month if without dependents, or $75.00 a month if he has one or more dependents.

(4) *When and where may the veteran attend college?*
He may attend any approved college or university which will accept him, and while there, he must meet the usual requirements and standards of the institution. He must start his program within two years after the end of the war, or if discharged after the end of the war, within two years after his discharge. The total period cannot exceed four years, and no education or training under the law can be extended beyond seven years after the end of the war.

There are a few qualifying and modifying clauses in the law, including:

(a) If the veteran was not over 25 years old when he entered the Service, it is assumed that his education or training was interrupted; if he was over twenty-five, and can prove to the satisfaction of the administrator that his education was impeded, delayed, interrupted, or interfered with, he can obtain the educational benefits authorized by the bill.

(b) If the veteran wishes to be gainfully employed, and take his educational program on a part-time basis (in evening classes, for example) he may do so, and have the equivalent of his allotted time. Thus, if he is entitled to three semesters at I.I.T. on a full-time basis, he can take 54 semester hours in the evening division, having all of his expense, including tuition, books, and supplies, paid by the Government. He must, however, forego all or part of the subsistence allowance, as determined by the Government administrator.

Public Law Number 16, Seventy-eighth Congress, provides certain benefits, including educational pro-

*The law says "—exclusive of any period he was assigned for a course of education or training under the Army Specialized Training Program or the Navy College Training program, which course was a continuation of his civilian course and was pursued to completion —". We are uncertain as to the way in which this will be interpreted. When the Administrator clarifies this clause, we will be notified, and will then be able to answer inquiries.

grams for which the veteran is qualified, to veterans who are honorably discharged with a service-incurred or service-aggravated physical disability and an established need for vocational training or education. These benefits are similar to those under the "G. I. Bill", except that the length of the educational program is not limited by the veteran's time in service, but may be carried to a reasonable conclusion, such as a four-year course in college which represents the maximum. Expenses paid to the institution on behalf of the veteran are the same; cash payments to the veteran, including his pension, will be greater than under the "G. I. Bill". While he must have been in the active Armed Service on or after September 16, 1940, he need not have served 90 days to be eligible under this law. This law is also administered by the Veterans Administration.

The "G. I. Bill" has been law for only a short time. There are no precedents in its application, and various interpretations have still to be made. The Institute is in close touch with the Veterans Administration which will administer the law, and also in contact with many institutions of higher learning, and other agencies vitally interested in the cause of the discharged veteran. We invite questions on the subject from interested persons, and suggest that such persons inquire of us, addressing the Veterans Counselor. The Institute is fully committed to the proposition that it must meet the educational needs of returning veterans to the fullest extent of its facilities, and within the areas in which it functions.

A committee on Planning for Returning Veterans, organized a semester ago, is studying the broad problems and their practical application, realizing that the problem is already with us in a small way, and that it will increase in size from term to term until there is a major demobilization. Fortunately, we can gain experience by practice while the problem is still small. This committee consists of the Deans of Engineering, Arts and Sciences, and Evening Division, the Registrar, the Director of Tests and Measurements, the Chairman of the Engineering and Arts and Sciences Faculty Committees on Post-War Planning, and the Veterans Counselor as Chairman. The committee is gathering information and opinions from a variety of sources such as the United States Office of Education, the American Council on Education, the Engineers' Council for Professional Development, and the Veterans Administration, the Armed Forces Institute, and numerous colleges and universities. Based upon these studies it is now possible to make rather definite commitments as to the Institute's present offerings to veterans.

It is expected that a million veterans will seek education or training under Government financing; half a million perhaps, at the college level. These figures are guesses, but are probably conservative. In any case, with the normal number of high school graduates seeking admission to colleges and universities, and the undoubtedly large number of men and women in strictly war industry who might otherwise have been in higher education, and the returning veterans, it seems certain that American higher education will face a great and unprecedented overload of candidates for educational programs at both the undergraduate and post-graduate levels. It seems probable, furthermore, that an abnormally large percentage of those seeking higher education will seek engineering, science, or such other curricula as will be the foundation for their making a living: Also, in many cases, their military service in a highly technological war will have stimulated their interest in technology. Moreover, the large number of men enrolled in the Army Specialized Training Program had a good start toward an engineering education, and many will be anxious to complete it, as will many men who were in the Navy College Training Programs but were unable to continue to graduation.

Illinois Tech may be expected to have a flood of applications for admission in all curricula and at all undergraduate levels, when large-scale demobilization has started. It will be our duty to society to provide maximum facilities for those who seek our programs, admitting the maximum number consistent with our facilities. It will also be a most important part of our obligation to admit only those who, on the records, are qualified for our curricula, and who may confidently be expected to pursue their courses with success and satisfaction to themselves. It would be a distinct disservice to the veteran to do otherwise. It is our plan to give all veterans applying to us the benefit of our best counsel through the Office of the Veterans Counselor and by the Department of Educational Tests and Measurements, the Psychologist, and the staff of Faculty Counselors.

There will be numerous applicants for admission who are high school graduates, but who are deficient in some of the specific requirements for some of our curricula, such as chemistry, mathematics, and physics. Some of these men may have studied some of these subjects in Service Schools, or by correspondence, or be otherwise capacitated to take tests for qualification. Such tests will be available. Others will need to study these subjects which are required because they are definitely prerequisite to the college programs. Since we think that it would be entirely out of order to ask veterans to take these subjects in secondary schools, we will offer these courses in the first year, making the balance of the student's program the regular freshman subjects. We are also foreseeing the probability that certain short, intensive courses of the "refresher" type will be needed, especially in mathematics, the physical sciences, mechanics, electricity, and perhaps others, for those who have advanced standing, but need review before picking up their sequences.

Almost all of our curricula in Arts and Sciences as well as in Engineering, are specific and lead to designated degrees. Therefore, the planning is similar in both divisions. Many veterans applying for admission will have advanced standing from other colleges, will have had one or more terms in the Army Specialized Training Program or Navy College Training Program, or will have pursued and been graduated from one or more of the hundreds of service training courses in the Army and Navy. Many will have taken courses by correspondence from the Armed Forces Institute or from accredited colleges or universities through the A.F.I. The proper and reasonable assignment of credit for all these varieties of work done is a major problem in the orientation of the veteran into his college course. The American Council on Education is in process of preparing a comprehensive book on the academic

Men or women honorably discharged from the Armed Services of the United States, or who, while still on active duty, are making their plans for education after discharge, are invited to write to, or to call upon,

C. A. Tibbals
Dean of Students and Veterans Counselor
Illinois Institute of Technology
3300 Federal Street
Chicago (16), Illinois

Full information will be furnished, together with instructions as to procedures, suggestions, and counsel.

"values" of work done under service auspices, whether given by the colleges and universities, or within the services themselves. Pending the receipt of this authoritative material, the Institute, by recommendation of the Planning Committee for Veterans has set up tentative standards for accrediting:

(1) Credits earned in accredited colleges and universities, whether in civilian status or in Service units (Army or Navy), with grade "C" or better, will be computed to their semester-hour equivalent, and given full credit, provided the courses are appropriate to our curricula. If too much time has elapsed between the time of completing the courses and the time of admission or re-admission to the Institute, tests may be given to the student to establish his competence to proceed in the sequence of his courses, or he may be offered "refresher" courses. It might be quite unjust to a student to start him in calculus, for example, if several years had elapsed since he completed his college algebra, trigonometry, and analytics, when a short, intensive "refresher" in these subjects might prepare him adequately to go ahead. It would, of course, be equally undesirable for him to use a whole academic year repeating these courses.

(2) Courses taken by correspondence through the Armed Forces Institute (at Madison, Wisconsin) are of two general types: Those offered by the A.F.I., and those given through the A.F.I. by accredited colleges and universities. The Armed Forces Institute does not recommend any credit by the colleges for the first type, but gives its own comprehensive achievement tests in the subjects taught by correspondence. Many colleges, including Illinois Institute of Technology, will consider individual requests for credit on the basis of satisfactory scores on these achievement tests if and when satisfactory norms are available. We may or may not require additional local examinations for credit. In the case of correspondence courses offered by accredited universities, and completed with satisfactory grade, I. I. T. will give by transfer the same credit that the university itself gives, provided, of course, that the courses so taken are appropriate to the curriculum which the student elects to follow.

(3) Courses of study taken by soldiers and sailors in the hundreds of service schools present the most complicated picture insofar as credit recognition is concerned. It is thought that the material referred to above as being prepared by the American Council on Education will be very helpful in this connection when it is available. Meanwhile, Illinois Institute of Technology will adopt the following tentative program:
No credit will be given directly for courses taken as part of an Army or Navy service school program, except that, when appropriate, some courses involving mathematics and physics or chemistry will be accepted as a substitute for high school units when high school preparation in those subjects is deficient. In case a veteran shows a basis for believing that his courses in service are equivalent to a course in our curriculum, he may take a comprehensive examination for credit and receive credit if he achieves a satisfactory grade. This privilege has always been open to students at the Institute. All academic departments will have a member of the sub-committee of the Planning Committee for Veterans who will function in such cases.
After World War I many colleges assigned a specified number of hours credit for military service as such. This is not being done now, except that colleges or universities which have required credit courses in Military Science will give equivalent credit to the veteran.

One of the major items in the program for veterans at the Institute, as in all colleges and universities, will be the re-orientation of the veteran into civil life. This will be largely his own problem but he can and should have help from his college. We have a counseling program for veterans, using the services of experienced advisors, and those of a professionally trained and broadly experienced psychologist. We are very conscious of the difference in interests and attitudes of veterans with combat experience, perhaps of long duration, from those of normal civilian students just recently out of high school, and every practicable means will be taken to keep the veteran happy in his college work and life, both in the curriculum and outside of it.

All of the above procedures and plans represent the Institute's effort to help the veteran make the best possible selection of an educational program, and to start it under conditions most favorable to him for carrying it to a successful and satisfactory conclusion.

The educational plans and programs for veterans are not entirely for the future. In the various divisions of the Institute, including Evening Division and Engineering, Science, and Management War Training, are at least 115 veterans. In the current semester which opened in July, 1944, there are 25 enrolled, all as full-time students in day classes. Each of these men has had special counseling and all are progressing and appear to be content. In general, they have been discharged from the military services by reason of physical disabilities. Several have pensions on account of these disabilities and are financed by the Government through the Veterans Administration. Nearly all of the others will come under the "G. I. Bill" next semester. Of these men, sixteen were students at I.I.T. before entering the Armed Services, five had work in other colleges, and four entered as freshmen. An association or club for veterans is now in process of organization, and is expected soon to take its place among recognized student organizations on the campus.

Present indications point to a substantial increase in the number of veterans to be enrolled next semester. Scarcely a day passes that the Office of the Veterans Counselor does not receive one or more personal calls or letters from prospective students seeking education under the "G. I. Bill", and the entrance of a number has already been approved by the Institute and authorized by the Veterans Administration. A substantial number of those seeking information and laying plans are still on active duty, both in this country and overseas.

In order that Illinois Institute of Technology may fully meet the inspiring challenge of veterans' education, major improvements in physical facilities are planned, and will be consummated as quickly as building materials become available. Included will be: increase in the number of classrooms; major improvement in the housing of the libraries; return to the students of facilities in the Student Union Building now required for official purposes; improvement in facilities and programs for physical education, for athletics, and for recreation; and the establishment of institutionally-controlled housing facilities for out-of-town students.

We believe that these things will be done on time, and that the challenge will be met.

ELECTRON WAVES AND THEIR USE IN MICROSCOPY AND DIFFRACTION

By

PAUL L. COPELAND and CARROLL W. LUFCY
Electron Microscopy Laboratory

Waves play many an interesting and important role in our civilization. Waves of sound and light are most common means both of acquiring and spreading information. Our most vivid impressions of the physical world stem from these stimuli. Appreciation of the arts depends upon sight and hearing. Radio waves carry news, instruction and entertainment to the far corners of the world.

Radio waves are clearly electromagnetic in character, since they are produced by electrical oscillations. Light waves are of the same basic type, but they differ in length. Whereas a single complete cycle of a radio wave may have a length of 300 meters or 1000 feet, light waves extend from about 0.00004 centimeters, or 0.000015 inches, for the blue to 0.000075 centimeters, or 0.00003 inches, for the red. Waves longer than red light are the infrared heat rays. Longer still are the microwaves and very short radio waves. Waves shorter than violet light are the ultraviolet rays, and shorter still are the X-rays. Waves as short as hard X-rays provide an interesting field for study and application.

The role of waves is even more fundamental than the foregoing review would suggest. Wave patterns represent the essence of the material universe. It was about two decades ago that this truth became apparent. De Broglie laid the foundations of wave mechanics by presenting reasons for believing that a moving particle would be accompanied by waves of length $\lambda = \frac{h}{mv}$ where h is Planck's constant numerically equal to 6.5×10^{-27} in c.g.s. units, and the mv product represents the momentum of the particle. If m is expressed in grams and v is expressed in centimeters per second, λ is measured in centimeters. Shortly after the publication of the paper by De Broglie, Davisson and Germer in 1927 found experimental evidence for electron waves in the diffraction pattern formed by the electrons reflected from a crystal lattice.

Fig. 1. The Electron Microscope of the Illinois Institute of Technology

A similar experiment had established the wave characteristics of X-rays a decade and a half earlier. The work of Davisson and Germer showed that the De Broglie formula for the wave length of a particle was correct.

The discovery that electrons had wave properties carried with it very important implications concerning the possibility of developing new and useful instruments for research. The waves accompanying electrons, moving with easily obtained speeds, are very short. Davisson and Germer working with electrons which had fallen through about a hundred volts of potential difference, and which in consequence were traveling with about the same speed as the electrons in a radio receiving tube, found that the electron waves were of about the same length as X-rays. This result was exactly in agreement with the prediction of De Broglie. In effect this means that extremely short waves can be produced quite readily. An electron which has a momentum obtained by falling through 100 volts of potential difference has a wave length of only 1.21×10^{-8} centimeters or about five billionths of an inch. An electron which, starting from rest, falls through a potential difference of 10,000 volts has a wave length only one tenth as great, that is 1.21×10^{-9} centimeters or half a billionth part of an inch.

The discovery of these short waves, and the development of the science which makes it possible to use them, has satisfied a long-felt need. For many purposes the waves of ordinary light are far too coarse. Visible light has waves the length of which is about a thousand times as great as the spacing of atoms in molecules or in solids. Such long waves are incapable of giving an image showing details concerning the placement of atoms in molecules or solids. Even in showing the size and shape of colloidal particles light waves are limited because of their coarseness. Basically all images are formed by the combination of waves to set up some sort of interference or diffraction pattern. In order that the pattern may be influenced by small details in the object, the waves must be so short as to be comparable with the size of the details to be shown. The image of very small objects appear surrounded by rings due to the wave properties of the light used. Microscopes using light waves are capable of showing as distinct in the image two small objects that are separated by as little as 0.00001 centimeters or about 0.000004 inches, but although much effort has been spent in the attempt to make them show finer detail, these efforts have not been successful, and even before the discovery of electron waves scientists realized that shorter waves should be used to examine smaller objects.

The design of suitable diffraction apparatus was not a serious problem. Previous work in X-ray diffraction had revealed many of the essential ideas. It is necessary only to produce a narrow, well defined beam of electrons of definite energy, to allow this narrow beam to fall on a target substance the regular spacing of the atoms of which is to serve as a diffrac-

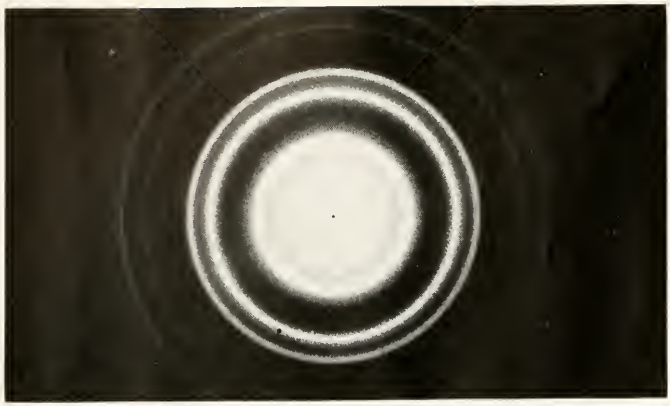


Fig. 2. Pattern Formed by Electron Waves After Passing Through Powdered Zinc Sulfide

tion grating, and to record in a photograph the pattern which the electrons leaving the grating form. In such cases the pattern does not constitute an image of the target material, but is due to constructive and destructive interference of waves, and is similar to ripple patterns which may be set up on the surface of water. If the substance used as a grating is a space lattice such as a natural crystal, where the atoms have regular arrangement in each of three directions, the observed diffraction pattern consists of a system of well defined spots, with perhaps a few fine lines. The spacing of the atoms in the crystal can then be computed from the position of the spots. If on the other hand the crystalline material is broken into small fragments, which are then packed in the form of a powder to be used as a target, the diffraction pattern consists of a series of variously spaced rings. From the separation of these rings characteristic atomic spacings in the target material may be deduced. The diffraction patterns observed by Davisson and Germer were formed by electrons reflected from a single nickel crystal. G. P. Thomson and others showed that diffraction patterns could be produced by shooting a beam of fast electrons through a thin target. Three pictures of the latter type made with the equipment at Illinois Institute of Technology are shown in Fig. 2, Fig. 3 and Fig. 4. The rings of Fig. 4 indicate that the size of the unit cube in a crystal of gold is 4.06×10^{-8} centimeters or 1.6×10^{-8} inches. The same considerations enable one to determine the crystal spacings as indicated by the other patterns.

The problem of utilizing short electron waves to form high quality pictures of small objects was not so readily solved. The fundamental step was the recognition that electric and magnetic fields of circular symmetry about an axis have the ability to focus electrons in much the same way that ordinary lenses focus light. This is the basis for the science of electron optics, and this new science, because of its many important applications, has been actively developed. In geometrical optics the tracing of light rays is a very important study, the elements of which are mastered by students of general physics. The tracing of electron trajectories is the analogous problem in electron optics, and it is now possible in many cases to trace electron trajectories without too great difficulty. The problem is complicated by the fact that the electron trajectory bends gradually in the fields, whereas in ordinary optics the refractions are very conveniently localized at definite boundaries between two media. Lenses which focus electrons by the action of electrostatic fields can be made by using charged conducting planes in which there are small circular holes through which the electrons pass or by using charged conducting circular cylinders through which the electrons pass along the axis. The quantity of electrostatic charge on the conducting elements of the lens system determine the power of the lens, and thus the focal length of an electrostatic lens may be varied by changing the potential difference maintained between the conductors of the lens system. Similarly if electrons move along the axis of a coil through which a current is flowing they will be focused, and the power of this magnetic lens may be regulated by changing the current in the coil.

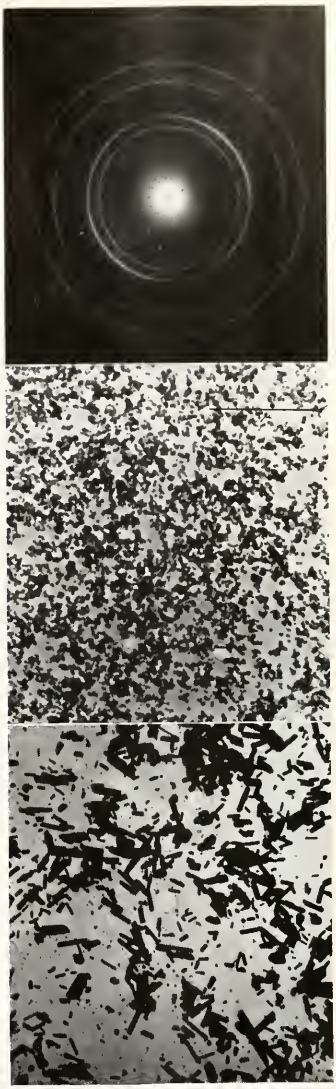
Electron lenses either of the electrostatic or the magnetic type may be used in combination to form microscopes of power greatly exceeding the ordinary optical instrument. Partly because the science of electron optics is comparatively new and partly because of fundamental difficulties, electron lenses of aperture comparable with the best optical lenses have not yet been produced. Sufficient progress in perfecting electron lenses has been made to permit the construction of microscopes almost a hunderd times as powerful as the best optical equipment. The basic reason for this success is the extreme shortness of the electron waves used. The fact that the power of such an instrument may be changed by simple electrical controls without any mechanical changes is an advantage that the electron microscope has over its predecessor which

Fig. 3. Pattern Formed by Electron Waves After Passing Through Mica

used ordinary light. Although the electron waves are not visible directly, observation may be made by means of the fluorescence which they excite on a suitably placed screen, or a record may be made directly since the electrons do expose a photographic plate.

Representatives of pictures made with modern electron microscopes are shown in Fig. 5 and Fig. 6. These were made on the R.C.A. Type B magnetically operated microscope at Illinois Institute of Technology. Fig. 5 shows a carbon black with particles running down to about 0.000002 inches in diameter. Fig. 6 shows a paint pigment containing small crystals. Even for the larger particles the high resolving power of the electron microscope gives the advantage of picturing sharply the details of shape. The microscope has the ability often to differentiate between particles even though they overlap.

Although electron diffraction cameras and electron microscopes are relatively new, the information which they have given concerning structure, size and shape of materials has been a substantial aid in the solution of a great variety of important problems. Applications of electron waves will continue to increase as their usefulness becomes more generally known.



From top to bottom, Figure 4: Pattern formed by electron waves after passing through gold foil; Figure 5, Electronmicrograph of carbon black; Figure 6, Electronmicrograph of crystals in a paint pigment.

ILLINOIS TECH A SPONSOR OF FIRST ELECTRONICS CONFERENCE

With an attendance nearing the 2,500 mark, nearly double the preliminary estimates, the first National Electronics Conference was held on October 5, 6 and 7 under the combined sponsorship of Illinois Institute of Technology, Northwestern University, the Chicago section of the Institute of Radio Engineers and the Chicago section of the American Institute of Electrical Engineers.

Chicago, rapidly becoming the capital of the electronics world, was chosen as the scene of the conference, with all sessions being held in the Medinah club.

Dr. J. E. Hobson, director of electrical engineering at Illinois Tech served as chairman of the executive committee, with a large measure of the national attention which the conference gained being due largely to his work and that of P. G. Andres, associate professor of electrical engineering, who served as chairman of the committee on arrangements.

Registration at the conference was nation-wide with the top-notch men in the field from both industry and research and educational institutions appearing on the three-day program.

In the first session on Thursday morning after Professor Andres had reported on the work of the arrangements committee, Ralph Beal, assistant to the vice-president in charge of the R.C.A. laboratories spoke on new frontiers which were being opened through electronic research.

Thursday's luncheon meeting was presided over by R. C. Ericson, chairman of the Chicago section of the A.I.E.E., with the director of the electronics laboratory of General Electric, W. C. White, presenting a paper on "Electronics in Industry."

Technical sessions started at 2 p.m. Thursday afternoon with sections on "Television," "Electronic Power Applications," "Electronic Aids to Medical Science" and "Survey of Industrial Electronics" taking place simultaneously on various floors.

In the survey section, Dr. C. S. Roys, professor of electrical engineering at Illinois Tech, spoke on the more important electronic devices encountered in industrial applications. In his discussion he included both vacuum and gaseous types of tubes and placed particular emphasis upon the characteristics of each tube and some of its better known applications.

Dr. H. T. Heald, president of the Illinois Institute of Technology, presided at the official conference banquet held at 7:30 p.m. Thursday. The banquet address of Maj. Lenox R. Lohr, president of the Museum of Science and Industry, concluded the first day's sessions.

Morning technical sessions on Friday were again divided into three groups with Dr. T. J. Higgins, associate professor of electrical engineering at Illinois Tech, being in charge of the section on "Recent Developments in Theoretical Electronics."

A luncheon meeting and afternoon and evening technical sessions on "Electron Tube Developments," "Industrial Applications; Electronic Devices," "Radio and Telephone Applications," "Ultra-High Frequencies," "High Frequency Heating" and "Industrial Radiography" completed the Friday program.

Addresses at the banquet on Thursday were presented to the conference by Rear Admiral Joseph R. Redman, chief of the naval communications, and Maj. Gen. H. C. Ingles, chief signal officer, through the medium of the wire recorder.

THE FIRE PROTECTION PROBLEM

By

ARTHUR H. JENS

The daily press contains frequent articles, far too frequent, that tell of losses not only to property, but of losses in human lives as well. To list the many accounts of fire losses that occur in any month would cover the entire issue of this magazine, but these samples, picked at random, will illustrate the extent to which avoidable fire losses are sending up in smoke many millions of dollars and many things of value that may never again be replaced.

June 4, 1944—Redwood Manufacturing Plant—Pittsburg, Calif. Fire reportedly starting in a dry kiln, burned for 8 hours over a plant covering approximately 60 acres mostly of combustible construction. Fire departments from several communities, aided by soldiers and a Coast Guard fireboat, were unsuccessful in controlling the blaze after a local water supply proved inadequate. Some 3,000,000 board feet of lumber, including much high-grade finished redwood, was destroyed. Loss estimated at $2,400,000.

A Million Dollar Fire That Could Have Been Prevented

International News Photo.

April 13, 1944—Steel Tube Mill—Ellwood City. Pa. Fire occurred in an unsprinklered one-story skeleton frame, iron-clad building used for the welding of seamless tubes. A leak in the gas service line to a salamander caused the fire which ignited kerosene at a tube straightening machine. Kerosene was used for cleaning rolls. Fire department reports that there was a delayed alarm and the entire plant was involved very quickly as employees attempted to put out fire with inadequate extinguishing equipment. Loss $338,000.

April 19, 1944—Feed Mill—Woburn, Mass. Fire was started by a welding torch in a frame metal-clad section of this plant, not properly cut off from the main section of concrete construction. Flames spread rapidly while employees attempted to extinguish the fire with a garden hose. Fire department pumpers were delayed by having to take suction from open water supply as adequate hydrant service was not available. Fire department reported that recommendations made to previous owners for improved water supplies had not been complied with. Loss estimated at $175,000.

May 2, 1944—Metalworker—Lebanon, Pa. Explosion of a fuel oil burner sprayed burning oil to the wood trusses of the roof of the heat treating department. This caused a fire which completely destroyed this unsprinklered plant. Some employees were injured by burning oil or were overcome by smoke. When the volunteer fire department arrived, the fire had gained great headway and within 20 minutes the entire roof was involved and in less than an hour the walls collapsed. Steel trusses of a new section of the plant twisted and pulled down practically all of the brick walls. A single fire area of over 73,000 sq. ft. and lack of private protection were major factors in this loss of over $400,000.

Almost 10,000 Human Lives Were Lost Through Fire in 1943

International News Photo.

March 19, 1944—Machine Shop—Chicago, Ill. Failure of watchman to transmit alarm promptly and to let the fire department in when they arrived, caused considerable damage to this 2 story brick, unsprinklered building. Loss estimated at $28,000.

March 27, 1944—Department Store—Fort Wayne, Ind. Fire occurred in a combustible attic space used for storage, located above a 4-story fire resistive mercantile building. The cause is unknown. The building was without sprinkler protection and the fire department found it necessary to use 20 hose streams to control this fire which also caused considerable exposure damage to a nearby bank building. Two weeks later the wall of the burned building collapsed and killed 6 persons. Loss estimated at $225,000.

March 29, 1944—Metal Worker—Scranton, Pa. This structural steel works was completely destroyed by fire which started in the compressor room on first floor. Poor construction and lack of any fire protection measures made it impossible to save the plant. Loss estimated at $32,000.

Reviewing these accounts we find mention of local water supply proving inadequate . . . delayed alarm . . . inadequate extinguishers . . . plant not properly cut off . . . adequate hydrant service not available . . . failure of watchman to transmit fire alarm . . . defective flue . . . poor construction . . . lack of fire protective measures—indicating that human frailties, although a major factor in many losses, are not without competition from things that may be controlled by proper fire protection engineering. The extent to which it may be regarded that some losses are avoidable is left to conjecture. Conservatively, if we assume that one half of the fire loss is attributable to causes that may be controlled, and allowing that management, the farmer, and the home owner are willing to take steps to eliminate such causes, the savings in dollars would reach a staggering total each year—for 1943 about $186,000,000. In war times an amount under $200,000,000 may be shrugged off when compared with the cost of conducting a military operation on foreign shores. Yet such a saving is a direct benefit to the people, reflected in lower living costs, lower rentals, lower insurance costs, and eventually lower taxes.

Are any classes or groups exempt from fire losses? The records do not prove that any are or may be expected to be so favored. Fire losses in industrial properties totalled in excess of $145,000,000 in 1943—more than 200 farm buildings burn each day in the United States and Canada—400,000 fires occurred in homes in 1943. Loss in human lives as a result of fire reaches close to 10,000 each year. A tremendous record, an awful record of waste that might have been avoided or at least stemmed if the people were aroused to doing something to save their own property, perhaps their own lives.

In what area of control may the

Fire Losses in Industrial Buildings in 1943 Exceeded $145,000,000

International News Photo.

answer to this confounding problem be found? Without question it remains with the people themselves. In following paths of least resistance we have permitted our industries, our farms, even our homes to be located in congested areas, and to be erected of materials that science has found to have only slight resistance to the ravages of heat and flame. We have permitted the use of obsolete structures, the use of hazardous volatiles, and the use of dangerous electrical devices—all without regard to our own safety. Although it is not possible to remove every condition that may not be regarded as conforming to present day fire protection standards, yet we can and must take steps to reduce or eliminate those hazards that are known to have caused losses.

What may be done? In removing accumulated rubbish and improving our housekeeping we have eliminated a favorite breeder of fires. Although this in itself will enable an improvement to be shown in the loss figures for any period of time, the over-all solutions are much deeper and will take a great deal more effort on our part to make them effective. It will require full cooperation between management, the farmer, and the home owner with fire protection experts to first recognize the hazards and then to take steps to eliminate them.

The time to consider fire protection is when a structure is in the "planning stage." At that time a wall may be removed or extended by a pencil mark, adequate clearance to other structures may be secured by erasure. Once erected, the fire protection problem becomes far more complex—and expensive. Free consultation should be had between the designing architect and the fire protection engineer for many minor items that seem of little consequence may have a large influence on ultimate protective measures. Manifestly the fire protection engineer is an expert in his field and by consultation with him the architect gains many points that he could not be expected to know. Often a suggestion regarding the thickness of a floor or the location of a fire door may be the difference between an economically successful or unsuccessful operation.

Where construction changes are considered for older structures or where an unrelated industry moves into structures designed for another type of occupancy, the problem is considerably more involved. Generally it is not possible to "change the structure," therefore, the protection of hazards and the installation of protective devices become the paramount issues. A word of caution is offered to use only materials and devices that have passed the acceptance tests of recognized organizations.

In existing operations where management has had a long period of successful operation without other than minor fire loss, the problem resolves

(Continued on Page 44)

FACING THE MODERN WORLD

Commencement Address

By

DR. GEORGE BIRKHOFF

George David Birkhoff returned to his Alma Mater, on June eighteenth to receive the honorary degree of Doctor of Science and to make the commencement address. Internationally recognized as one of the world's greatest mathematicians, he holds twelve honorary degrees and is an honorary member of The National Academy of Science, Gottingen Scientific Society, The French Academy of Science, The Royal Danish Society of Science and Letters, The Royal Academ of Lincei, The Academy of Sciences of Bologna, The Royal Irish Academy, and The Royal Society of Edinburgh. The Engineer and Alumnus believes that Dr. Birkhoff's address to the graduating class is significant enough to publish in its entirety. The address follows:

Dr. George Birkhoff, L. Ac. '02

"President Heald of Illinois Institute of Technology, Faculty Members, Members of the Graduating Class, Students and Friends:

Perhaps never before have so many powerful forces impinged suddenly upon the human race as in recent decades. These are clearly associated with the technological advances made possible by modern scientific knowledge. But, despite the spectacular material progress, mankind does not seem to be much nearer to any final happy goal than before. The young man or woman about to start on the adventure of active life finds it increasingly difficult to secure a positive outlook by which to meet the materialistic onslaught. Let us then consider together certain ideas which are likely to be important in this connection especially after the present period of national emergency shall have passed.

At the beginning it is well to remember that the world has never been an easy place in which to grow up and develop. Perhaps some day an effortless and painless Utopia may be obtained. But up to now, there has been no achievement of successful or noble personality except by the hard way of trial and error, of long struggle and final accomplishment. In the last fifty years many social maladjustments have been corrected, and conditions of living have improved for the ordinary man. But the problems and difficulties of the individual today do not seem to be less than they were thirty or forty years ago. For, in this modern age, it is ever whispered in our ears: "Whatever you want is yours; you have only to reach out and take." Yet this is an insidious, Circe-like illusion. If our very soul is not to be jeopardized, we must refuse to listen. This calls for strong character and fixity of purpose.

What has helped you of the younger generation most so far is doubtless just what has helped others who have gone before you—the sustaining inspiration of parents and family, of classmates, of your teachers and advisers at Illinois Institute of Technology and elsewhere. With how much affection and gratitude I look back upon my days at Lewis Institute, with its fine staff of teachers and its great Director, George Noble Carman! You of the splendid Illinois Institute of Technology, which continues and expands so vigorously the traditions of both the Armour Institute of Technology and Lewis Institute, have felt similar inspiring and ennobling influences, transposed to the higher key of the present day.

But now you of the graduating class are about to sally forth on a career of your own. More than ever before, you need to have within you strong and independent springs of action to guide you through the difficult and stirring days ahead. What shall these springs of action be? This is the very difficult question which it is worthwhile to consider as frankly and constructively as possible. The suggestions which I will make by way of answer may possess some especial relevency because my background has been similar to yours, and to this there has been added a long and varied experience.

Everything happening around us bespeaks for us all the urgent need of a proper comprehension of our own country and its international relations. One essential fact in this general situation was presented to me tersely and picturesquely many years ago by a friend then well along in years, Colonel William Roscoe Livermore, a well-known army engineer, versed in military history. He said: "To me it is completely obvious that the United States is destined to be the Rome of the twentieth century." What he meant, of course, was that there would come about an extraordinary development of material power in our land; and his prophecy has been amply fulfilled up to the present time. Colonel Livermore was not in the least nationalistic in his attitude. He was merely reporting on what he saw clearly ahead. Perhaps if he were living today, he as a trained historical observer would concede that the great Soviet Union is likely to emerge as a second unit, comparable in magnitude and potency with the United States.

Now, while all of us would agree as to the extraordinary industrial and technological development of the United States, my estimate of the significance of this development may differ somewhat from that ordinarily held in our country; after all, I have spent much time in Europe, in the Orient, and in Latin America, and

have naturally been influenced thereby. In my opinion, many Americans fail to realize what appears to me to be a very important fact, that fifty years ago the United States was still an almost negligible factor in many of the most important intellectual fields. For instance, in my own fields of mathematics and theoretical physics, we had done but little in this country, while Europe had a wondrous record of continuous achievement, in these and other scientific directions, extending over hundreds of years. In science, in art, in literature, Great Britain and the Continent had built an incomparable tradition in which we were slow to take part, being occupied in pioneering a new continent.

Even as late as the beginning of the present world struggle it would have seemed more correct, to most Europeans at least, to compare the United States, in the domain of the highest things of the spirit, with Great Britain, or with France, or with Russia or Italy or Germany individually rather than with Europe as a whole. Their venerable Europe had been the seat of Greece and Rome, of early Christianity, and of the Renaissance, and had led world civilization up to the beginning of the present century. For our own sake let us hope it may again be resplendent in the not too distant future!

It is well for us of America never to forget this marvelous heritage of Western civilization which Europe has given us. We must make it clear to the entire world that we appreciate its inestimable value for the spirit of man. In proportion as we give ourselves over to more comfortable living, and fail to do our share to advance this cultural tradition to the loftier heights still to be achieved, the rest of the world will hold us to be unworthy possessors of the immense wealth and material power which we have garnered for ourselves.

Perhaps then our extraordinary physical development indicates more than anything else that the Europeans who came to America were stimulated by its undreamed of resources and gave themselves over to developing and enjoying them.

There are at least two possibilities of serious limitation and error in the European point of view towards America which it is well to state explicitly. It must not be overlooked that our material strength has only been won at the cost of immense constructive effort and infinite drudgery on our part; and that, on the spiritual side too, our contributions are becoming more and more of the first order of importance. A distinguished European mathematician said to me about 15 years ago: "You in America are destined to produce the dollars and materials. It will be for us in Europe to do the rest." He was badly mistaken as I tried to convince him, by pointing out American achievements in mathematics during recent decades. Perhaps he was just the European counterpart of some Americans of limited vision who have been inclined to regard Europe as a picturesque and historically interesting continent to travel in but of no great actual importance!

A second erroneous belief that is to be found in Europe and elsewhere is that the physical advantages which we have achieved in the United States are solely material, in their nature. Good food for all, excellent buildings for schools and homes, modern libraries and laboratories, adequate medical care, etc., these are *not* things of merely material importance, they possess tremendous spiritual value as well. My dear friend, the great Chinese scholar and philosopher, Dr. Hu Shih, once told this truth to his people, of whom many had been inclined to look upon American and Western civilization as primarily materialistic.

Perhaps there has lurked beneath much foreign criticism of our American civilization a latent feeling of envy. This is not hard to understand from the human point of view, any more than is our own tendency towards smugness of outlook. Let us all forget such petty feelings and labor together to make this world a better and more inspiring place to live in!

Thus we of America, and especially you of the younger generation, must cultivate a broad, intelligent, and sympathetic understanding of the relation of the United States to other nations. We must do our utmost to become real citizens of the world, conscious of our responsibilities. Incidentally, those of you who have made some progress in learning a foreign language, and who follow it up through reading and travel, will be in an especially advantageous position. We of the United States do not as yet compare favorably in this respect with educated Europeans and Latin Americans, for instance.

Now it is all too clear that we have a kind of world of reduced dimensions within our own national borders. This situation also calls for careful and earnest consideration. It is obvious that we are far less homogeneous in our population than a country like England for example. On the other hand, we are less diversified than Russia or India. It is the attitude of practical wisdom and genuine humanity not to be obsessed by group prejudices, but to maintain a liberal point of view. The lack of a spirit of fair play and "live and let live" in parts of Europe and in Japan has been a definite and important factor in bringing about the present world conflict. It is an imperative duty to continue in full vigor the standards of justice and objective consideration, as you have found them, for example, within the fair walls of Illinois Institute of Technology. Probably various American problems which appear threatening today will later on reveal themselves as not so difficult after all, just because of processes of good will and generosity toward all set in motion while there was no certainty of a successful outcome.

Today, then, more than ever before, breadth of international and national outlook is closely correlated with personal breadth and serviceability as a human being.

Also, along with this breadth, there is necessary the saving graces of good humor and common sense. Moreover we must be able to change our minds. A professor of mathematics in a Russian Artillery School used to say to his classes some 25 years ago, "When I was young they told me that water was HO. Since then I have been told that water is really H_2O. But I don't like to think so even now." Most of us are a little like that with our cherished opinions.

As far as true success in a career is concerned, there are necessary of course the fundamental virtues of diligence, efficiency, loyalty, and honesty—virtues to which all of us are committed in our daily lives. However, human experience shows that, at long last, most individuals do have difficult moments of exceptional moral trial, which cannot be foreseen in advance and yet against which one must somehow be armed. Fortunately we have had excellent scientific training and are imbued with the scientific spirit. Hence we know how to think straight, without deluding ourselves, and that is a tremendous help in such emergencies.

But there is another source of strength which has been borne in upon me by personal experience. As a boy of 12 years of age I began to be deepy interested in mathematics. This was not in the least because there was money to be gained in a mathematical career—quite the reverse!

Nor did I particularly desire to teach. It was merely that I was attracted to mathematical investigation, which has remained my dominant interest ever since. My conclusion from this personal experience and the observation of others is that the young man or woman is indeed fortunate who has a strong liking for some particular field of effort, and follows it with earnestness and devotion, regardless of considerations of immediate advantage. Such a person is likely to go far in the direction of his choice, whereas the individual who thinks he has found a short road to success, not involving a vital interest of his own, is likely to fail; or, if he succeeds, he frequently develops instability of one kind or another. For, human beings crave and require sincere devotion to worthy ideals and loyalties of a congenial type in order to have a satisfactory steady development. On this account an intensely desired goal is about as favorable a determinative factor for the individual as can be imagined. There is a fundamental difference between the person who has a dominant directive purpose, and the person who lacks it. In fact, gaining such purpose rings about a kind of mental *conversion,* necessary for our intellectual salvation!

When we are thus adequately motivated in our actions, we are led, step by step, to increasingly deeper insights in our profession or wherever it may be. The man or woman who with high ideals thinks courageously and honestly about personal problems, is enabled to solve them. The scientist working in his study or laboratory to advance his chosen science reaches an unexpected, unifying point of view. For example, the great English chemist Faraday, speculating about electro-magnetic phenomena, was led to believe in what he called the "conservation of force," now called "the conservation of energy." The characteristic progression is from common-sense intuition, to reasoned conclusions and finally to faith. This three-fold progression is characteristic of development in all fields of endeavor, whether social, scientific or professional. The faith so won may not be wholly true, but it is always the essence of what is important for the individual, that by which he can live and advance.

Thus my second conclusion is that if you choose a direction of effort on the solid ground of a natural interest, and pursue it with all of your strength, you may count upon measurably achieving your goal or even something beyond it. The promise "Ask and it will be given unto you" is fulfilled in the immense world of mind and soul, if not always in the materialistic sense.

Incidentally, it will be well worth your while to extend your understanding of this world of ideas and ideals in directions which you have not hitherto studied. Within a few weeks a noted English scientist and engineer said to me: "We in our country do not feel our education to be finished when we graduate. On the contrary, we feel that afterward there are to be found the best opportunities for delving into new fields, of art and literature for example, and we look forward to doing so with the greatest anticipation."

This world of ideas and ideals is of more basic importance than the average workaday person is likely to realize; it is truly written that "man does not live by bread alone." We of America must give more than lip service to this unseen world if we are to be worthy of our destiny. There is the more danger of our falling short in this respect, individually and nationally, just because we have enjoyed the fruits of an extraordinarily material development. Probably we are the most prodigal and generous people on the globe—and yet, at the same time, we might be almost destitute of vital faith in the things of highest importance for the human spirit. Let us be on our guard against a besetting national failing in this direction.

To convince doubters of the importance of this expanding, other-world of the spirit requires more than a few phrases. Perhaps it may serve to mention the field of pure mathematics, which is but a typical instance of other fields of thought. The mathematics discovered and used by the Babylonians, Egyptians, and Greeks was substantial. We are familiar with the names of the Greeks Pythagoras, Archimedes and Euclid. Ever since, there has been an extensive if irregular advance in mathematical knowledge. In the last fifty years the total amount of mathematical knowledge has certainly doubled, in quantity and depth. This advance has brought with it the discovery of chains of logical reasoning by which alone it is possible to understand and dominate Nature. The character of all philosophic thought about the universe, has been deeply influenced by this mathematic advance; for the Universe, in its subjective and objective aspects, turns out to be mathematical to an astonishing extent. Yet the mathematical phase forms only the first of the sequence of ascending levels of knowledge making up this world of ideas and ideals—the mathematical, physical, biological, psychological, and social levels!

To summarize, then, we must strive for a broad and well-grounded international and national outlook. This will have favorable repercussions upon our own personal development. Secondly we need to have worthy and congenial goals and ambitions which take account of imponderable realities as well as of concrete fact. These will lead us to human service, to creative insight, and to vitalizing faith.

All of this might be presented in the following way: As a counterbalancing influence to the materialistic forces of present-day technological civilization, a new injunction has been laid upon mankind: *to know and to understand ever more broadly and deeply*—global affairs, national conditions in our variegated American scene, the world of ideas and ideals, as well as the physical world around about. Only in this way can men remain masters of their own destiny.

Finally I would suggest that the ultimate extent of personal accomplishment is likely to be measured by the unbounded quality of one's thought and effort. My whole effort has been directed to mathematical investigation, and I have had a grand time doing so. Such as it has been, my best work has generally required a bit more than seemed available at the time. Perhaps the highest success of any man is something like that; when a peak of accomplishment is reached it is not by luck, or by ability, but because of an indefinable something else which we may call *character.*

This is not an easy last thought to leave with you, but I am sure that, facing this modern world, you are stimulated by the prospect of the thrilling race before you, and will forge ahead with all possible energy and enthusiasm. In this ever recurring and ever new race which the successive generations of young men and women must run, you have our best wishes and our confident faith that your accomplishment will be of the highest order."

THE PRESENT AND FUTURE OF E.S.M.W.T. COURSES

Five very interesting and comprehensive articles on ESMWT courses have appeared in the Illinois Tech Engineer and Alumnus magazine in 1940 and 1941. These articles were written by Professor Joseph B. Finnegan and John I. Yellott and very ably describe the inception of these courses and their progress up to January, 1942.

During this period great stress was laid upon the training of technicians for work in the fields of inspection, mechanics, electricity and drafting. The volume of students enrolled throughout the nation is approaching 2,000,000. During the current year ending April 30, 1944, 344,930 individuals were enrolled in 196 colleges and universities. It is interesting to note that this year's enrollment consisted of 264,073 students in Engineering, 11,146 in Chemistry, 9,167 in Physics, and 118,298 in non-engineering Production and Supervision.

In the Chicago area a very unique program was set up under the title of "Fundamentals of Industrial Engineering". This course was offered to men who had at least a high school education, who had been successful in civilian industries, but who had lost their places in industry due to war restrictions. About 120 of these men enrolled in the summer of 1941 at the Illinois Institute of Technology and about 100 at Northwestern University. They attended school from 2 to 10 o'clock (five days a week for ten weeks). The pre-requisites for the courses were a high school education or its equivalent, good health, and a willingness to accept a position in war industries.

They ranged in age from 39 to 60. Some had engineering and other college degrees but many had not been in a classroom for ten to twenty years. The subjects consisted of the following: Production Processes, Materials of Industry, Drawings and Specifications, Industrial Organization, Supervisory Techniques, and Industrial Accounting. At the end of the first summer these groups were graduated and ready to enter war industries in supervisory positions. Numerous check-ups revealed that the graduates held such responsible positions.

Although graduate engineers may look upon this story with some skepticism, it must be remembered that these men brought to the classes years of maturity, experience, judgment and deadly earnestness which unfortunately does not so often occur in the lives of students between the years of eighteen and twenty-two when attending college. Although many of these men entered this work as a wartime expediency, a number of them have expressed the intention to stay in the present field as they found it more to their liking than their pre-war occupations. Since the summer of 1941, IIT alone has continued offering this course and up to the present writing, has trained over one thousand men for supervisory services. It is unique in being the only college in the country now offering a course of this kind.

Although a number of colleges have been offering courses especially adapted to the training of foremen, it fell to the lot of IIT to have an opportunity to handle the courses in a very unique manner. The works manager of the Nordberg Manufacturing Company in Milwaukee conceived the idea of sending his foremen in relays to Chicago for periods of two weeks each so that they could attend school eight hours a day to take the course in "Human Factors in Industry and Management Methods and Labor Laws". His theory was that when men work intensively eight to ten hours a day they cannot benefit to any great extent from evening courses because in addition to being fatigued,

Foremen Inspect Mechanism of Mine Hoist Made by the Nordberg Manufacturing Company

they have the distractions of home life.

His company was willing to send the men to Chicago, pay their expenses while living at the Morrison Hotel, and pay their wages. He interested four other companies in Milwaukee who also sent enough men to make a group of about twenty for each succeeding two weeks. These courses ran consecutively from about January, 1944, until the middle of June, 1944, when they adjourned for the summer vacation periods with the expectation of resuming in the fall.

The courses consisted of foremen-management relations, industrial organization, sources and adjustment of grievances, human factors in the foreman's job, Federal labor laws, worker evaluation, personnel management, understanding the workers' attitude, production planning, fire protection and safety, job evaluation, industrial health hazards, tool engineering, and psychology of handling workers. The school hours were from 12:30 in the afternoon until 10 at night. During the morning periods they found time to visit other industries in Chicago.

During the past year some new subjects have been introduced to the program in the Chicago area. A course in Wood Technology was offered to persons engaged in the manufacture of wood products in connection with the war effort. Due to the scarcity of metals the government set up many requirements for the use of wood as a material. However, the changes and improvements in wood technique have been so drastic and rapid that very few individuals had time to work in the new applications.

A course in Wood Technology was sponsored for the Chicago Furniture Manufacturers Association, while another course dealing with the same subject was made available to the public. Altogether over 200 individuals have taken the courses in Wood Technology thus far. Under course content the following items were offered: An extensive survey of the general nature of wood including its structure, properties and conversion into industrial raw material; drying problems; shrinkage and expansion; decay of wood and its control; plastics from wood; plywood and its properties including methods of manufacturing, bending, molding, impregnation; synthetic resin adhesives; and industrial applications.

The petroleum industries, because of their increased production and large additions of new help, required training in the techniques of the industry. A course was established which included the study of petroleum and motor fuels obtained from different sources; chemical treatment; storage and distribution; theory of lubrication; manufacture, applications and utilization of different kinds of

Nordberg Foremen Watch Operation of Full-Sized Mining Hoist Installed at the Museum of Science and Industry by Their Company

oil; utilization of wastes and physical tests; fuel oils and types of oil burners.

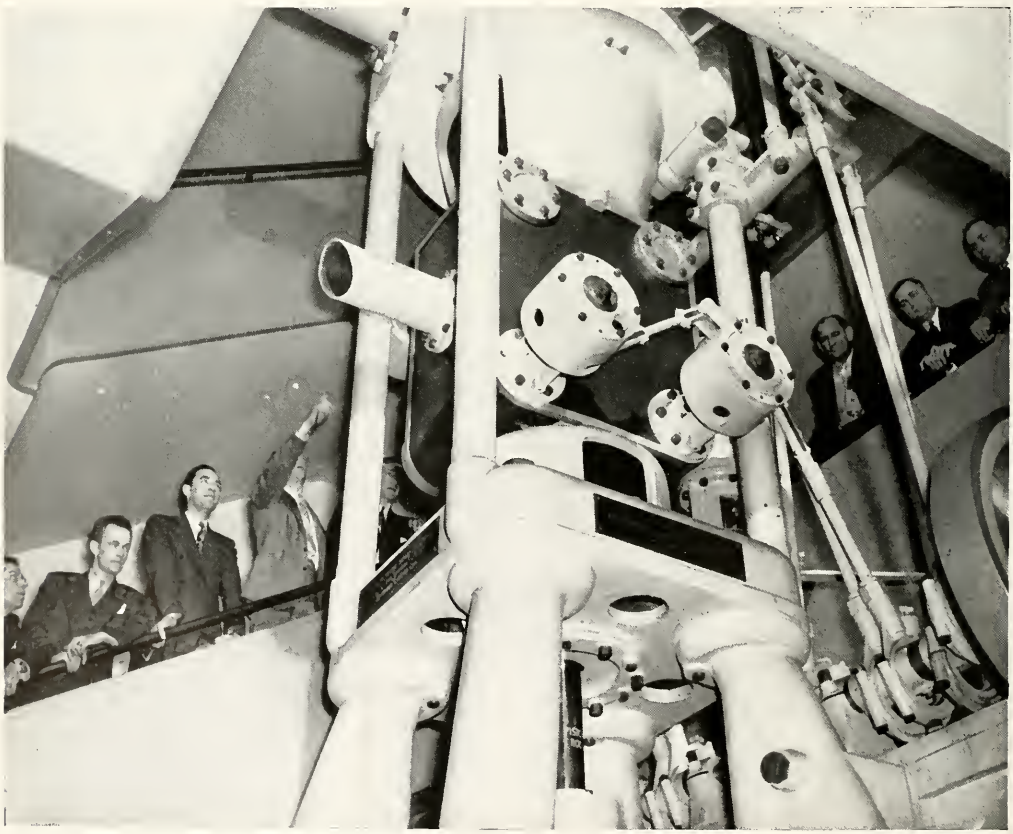
In January, 1944, the U. S. Office of Education reported that the railroads throughout the country were hard pressed for aid in handling the tremendous load brought on by wartime transportation. This need was met in the Chicago area by the development of a course in Traffic Management for the employees of the Chicago, Northwestern Railroad and courses in Railroad Accounting and Personnel Management for the employees of the Illinois Central Railroad. These courses were given on the premises of the railroad companies and confined to their representative employees for up-grading purposes. At present writing the Chicago, Milwaukee and St. Paul Railroad has applications in for several hundred of their employees who wish to take courses in Accounting and Traffic Management.

During the first year of the ESMWT program, most of the instruction was offered in the classes to individuals who took them for preliminary training for jobs in war industries. Since most of the suitable individuals are either in the armed services or already in war industries, the trend in ESMWT courses is rapidly becoming involved in up-grading in the plants of industry. In the Chicago area thousands of employees have been given in-plant courses in aircraft instruments, tool inspection, industrial management, applied mathematics, heat treatment, engineering drafting, radio and electronics, time and motion study, job evaluation, industrial safety engineering, strength of materials, hydraulic circuits, diesel engineering, etc. These courses are tailormade to the particular industry for which they are given. The Training Director of the Douglas Aircraft Company stated that the courses given for them in their Park Ridge plant would differ greatly from courses in the same subject given in their California plants due to local conditions and methods.

The ESMWT program was set up to take care of the needs of training for war industries for the period of the war. As soon as peace is declared the program will automatically end within sixty days after such declaration, unless Congress decides to continue under other objectives.

Just recently Congress passed the so-called "G. I. Bill" which grants additional privileges at government expense to any enlisted man who has been in service over ninety days. Some of these men are already availing themselves of this training under the ESMWT program. For compactness of courses, definiteness of aim and extreme earnestness on the part of the students and instructors, this program offers an advantage to those who wish to enter industry in the shortest possible time.

(Continued on page 48)



Students of ESMWT Courses View Ore Crusher in Operation

HELP! HELP! HELP!

By

JOHN J. SCHOMMER

The average monthly salary, based on a forty hour week for the February 1944 graduating class of engineers, was $193.84. This is by far the highest ever attained by any previous class. This does not include men who took commissions in the service or those that were inducted into service immediately after graduation. Nor does it take into consideration those that graduated in June 1944. The June class was small in number and all took commissions or were inducted into service except the 4-F's and 1-A(L's).

By departments the monthly salaries based on a 40-hour week was as follows:

Arch.	$169.89
Ch. E.	178.40
Civ.	188.84
E. E.	184.28
Fire Protects	190.00
M. E.	203.89

The mechanical engineers' average monthly salary is a little out of line with the other departments because there are included numerous Co-op M.E.'s who have had varied experience in industry. These Co-op students were able, due to their work experience, to obtain a higher rate of pay than the other seniors without or with little actual work experience.

On Changing Jobs

About thirty alumni working in various defense industries visited our placement department last week (August 6th to the 11th) seeking changes of positions to peacetime industries. Also numerous telephone calls and letters, from our alumni during July and August, have been received indicating the same desires. Recently numerous men throughout the United States have quit or tried to quit their defense jobs for peace time industries.

However, as favorable as the war situation appears to us now, remember there are still eight millions of splendidly armed Germans to lick, as well as the Jap Army and formidable Jap Navy. This World War II, like a game of football, will not be over until the last shot is fired. In the past, many a rosy situation in a war was upset by unforeseen circumstances. So to win the war our country must keep on producing the essentials of defensive and offensive war materials. It is better to have a thousand bombers too many than one short of victory. In many industries of high priorities there is an urgent demand for workers of all sorts. These materials must be kept going to the front in prodigious amounts and with great haste.

To prevent wholesale jumping to peace time jobs the United States Employment Service has had to enact some severe regulations. It is their purpose, in order to maintain the desired steady flow of war munitions, to funnel manpower to where it is urgently needed.

If you are working and not a 1-C classified person (discharged soldier) and you desire to change jobs there are some rules you must obey. I can not give you all the details but here are a few regulations you must follow: First, you must obtain your employer's permission, if in a defense job of priority, to quit. He then gives you a certificate of availability. You must then go to your nearest United States Employment Service office and register that you desire to change jobs. Your U.S.E.S. consults their books to ascertain the demand for personnel of your skill. If there is no demand, we will give you plenty of leads. We have that right of referral granted us by the U.S.E.S. If you are a 1-C or have been out of work for sixty days, we will also give you leads. If in a non-defense plant and you are shifting to a defense plant, we will give you leads. If you are leaving your job for one of higher priority and where your skill will be more fully employed, we will give you leads.

If your employer refuses to grant your certificate of availability, there are other ways of obtaining it, but you must have a valid reason. For instance, your health may be impaired by your job; there is sickness in your family and you must move to a more favorable climate; or illness may produce a great hardship on you or your family; or your skill may be more fully used in another defense industry. There are other circumstances besides these mentioned. Go to your nearest U.S.E.S., state your case why you want a change, and an investigator from the U.S.E.S. will be sent out. If he deems your case worthy, you will be granted your certificate of availability by the U.S.E.S. Then you are free to change to a job sanctioned by the U.S.E.S. If you now are still in doubt of what to do, go to your nearest U.S.E.S. and they will inform you.

Big Demand for Engineers

The office is still besieged for B.S. degree engineers and for engineers with masters' and doctors' degrees. Many requests have come in for research positions, for development projects, for salesmen, for draftsmen and designers.

The office has been working on a post war list of industries since the first of the year. Every industry we have had dealings with has been sounded for post war possibilities. So be sure you have your placement record in our office. Should the war suddenly terminate, no matter where you are, establish contact immediately with us so that we can be of immediate service to you. A large number of industries for the post war period are interested in hiring service men who have their B.S. degrees and, of course, as always, hiring men of ability whether they have been in service or not.

BETTER MOUSE TRAPS

Synchro Motor Systems

By

RUSSELL J. TINKHAM

This article is about an excellent and widely used system of remote indication and control little known outside of the electrical industry but which has many possibilities as a tool in the laboratory.

If the rotor of a synchro motor (often called "Selsyn" motor, a trade name) be displaced a given number of degrees of angular rotation, then the rotor of another such synchro motor, connected in parallel with the first, will be displaced a like number of degrees. In fact, if the first synchro, called the generator, (Fig. 1, G) is of sufficient capacity, several motors hooked in parallel as indicators (Fig. 1, M_1 and M_2) will all indicate the same angular displacement at each of many locations. A ship's gyrocompass system is an example of this fundamental indicating system. Because of its bulk the gyro with its drive and controls is most easily installed deep within the ship. Its information, the indication of true bearing, must be relayed to the pilot house, where it replaces the magnetic compass with all its attendant ills in steel ships. This relay of information is made possible by the synchro system. The position of the generator rotor at the gyro is reproduced not only at the helm but also at the navigating bridge, the chart room, the captain's quarters, the emergency bridge aft, and any other place where true bearing information is needed.

A good synchro system is accurate to one degree. If it is geared up to an indicator at a ratio of, say, 100 to one, then the indicator accuracy becomes 1/100 of a degree. The average system in use at present is good from a stalled position to about 200 r.p.m.

Other commercial uses of the system include indicating the angle of a bascule bridge, or the swing of a draw bridge, or communicating to the central station the volume of gas in a gas tank many miles away.

Security regulations do not permit the disclosure of the many new and fascinating ways that synchro systems are being used in the present war on land, on ships, and in aircraft. The Armour Research Foundation has made use of the system in novel ways in devices developed specifically for the armed forces. These instruments, now in production, are seeing service on the fighting fronts.

Not only is a synchro system a good indicator, but it also is a good control device. (See Figure 2). Suppose a large mass is to be repositioned

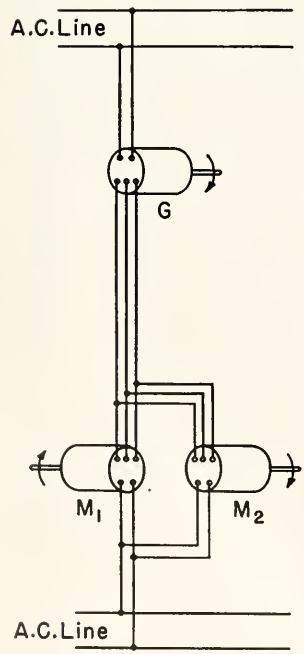


Fig. 1

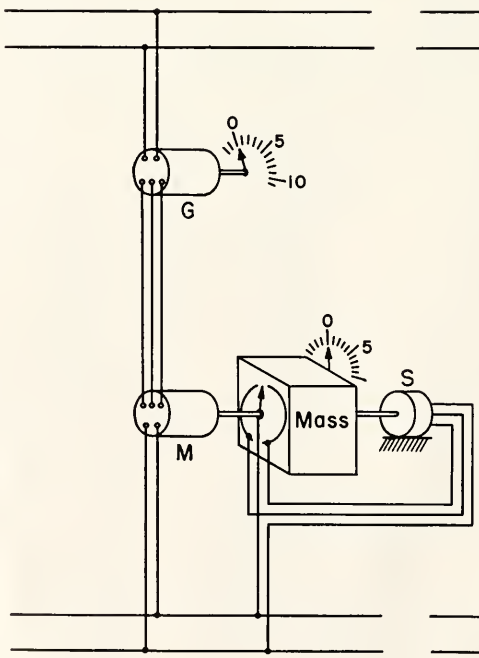


Fig. 2

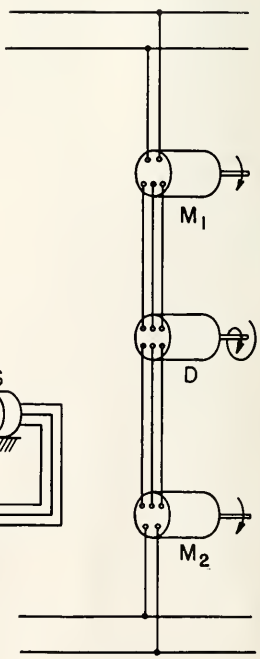


Fig. 3

or is to follow some prescribed change in angular position with respect to time, and that it is desired to control this from some remote point. If a servo, or slave motor of sufficient power is provided to move the mass at the required speed, the synchro system may be so designed as to influence the servo motor through a follow-up contact system mounted on the mass. When the mass is swung to the desired position the follow-up contacts will open and stop the servo.

A remarkable extension of the utility of the system involves the differential synchro motor. If a differential synchro is hooked between two standard synchro motors (Fig. 3) its rotor will give the algebraic sum of the angular displacement of the two synchros. That is, if, in Figure 3, M_1 rotates one turn clockwise and M_2 rotates one turn clockwise, then D will turn two turns clockwise; or if M_1 and M_2 turn one turn clockwise and counter-clockwise respectively and at the same rate, then D will not move at all. Or if the rotor of M_1 is held fast and the rotor of D is turned through one revolution, then the rotor of M_2 will turn through one revolution also. From this it is seen that with two electrical inputs to a differential synchro a mechanical output may be obtained, or with one electrical and one mechanical input, an electrical output may be obtained. Truly a device of many uses.

Basically, a synchro is a special kind of induction motor. The rotor has two pole pieces and its windings are connected to a single phase a.c. circuit. The stator is three-phase-wound, on three pole pieces. When voltage is applied to the windings on the rotor unequal voltages are induced in the stator. If this three-phase stator be coupled to another similar motor then the second three-phase stator will force the associated energized single-phase rotor to assume a position in the field where no current will flow in the secondary (three phase) circuit. The amount of torque of the rotor obviously varies from zero at this electrical zero position to a maximum at 180° displacement from zero. Since the motors are not in themselves powerful it is necessary to resort to power control as illustrated in Figure 2.

It is predicted that many more commercial uses for synchro systems will be found after the war, as a direct result of their many uses in war.

ORDNANCE AWARD

The Ordnance Distinguished Service Award in recognition of scientific and engineering achievement was presented to Illinois Institute of Technology at a formal ceremony held in the auditorium of the student union building at 11 a.m., Ocober 11.

Brig. Gen. Donald Armstrong, commandant of the Army Industrial college, and former head of the Chicago ordnance district made the award for army ordnance.

The program, with James C. Cunningham, president of the board of trustees presiding, opened with the Illinois Tech band in a musical prelude followed by the playing of "America."

Remarks by John I. Yellott, chairman of the War Training committee and director of the Institute of Gas Technology, were followed by a short address by Mayor Edward J. Kelly.

The award, presented by General Armstrong, was accepted by Dr. Henry T. Heald, president of Illinois Tech.

In working with the ordnance department in the Engineering, Science and Management War Training courses, Illinois Tech set up the only explosive safety course in the country which ran from July, 1942, to December, 1943, and trained the key workers in most of the explosive plants in the nation.

These courses were put on for the chief of ordnance, ran for a six weeks period and included both men and women in the training.

When General Armstrong, then Colonel Armstrong, was head of the Chicago ordnance division, the ESMWT courses also trained approximately 1400 inspectors for ordnance work.

The general ESMWT courses at Illinois Tech have been the most extensive of those in any private school in the nation and the largest in any metropolitan center.

Over 50,000 men and women have gone through these courses with the majority of them being employed in work directly related to army ordnance at present.

HONOR RETIRING PROFESSORS

Four persons who have served a total of 129 years on the staff of the Illinois Institute of Technology and its predecessors, Armour and Lewis Institute, are retiring at the end of the current semester.

They are: Dr. Ernest H. Freeman, professor of electrical engineering; Robert V. Perry, professor of machine design; Arthur H. Carpenter, associate professor of metallurgy; and Miss Olive P. Hazel, instructor in physical education.

These four persons will be presented with documents attesting to their long service at the commencement exercises on October 25.

Professor Perry is the only remaining charter member of the Armour Faculty Club. He is also an Armour alumnus having been graduated from the institution in 1897 and on the staff since 1902.

Professor Freeman has been on the staff since 1905, Miss Hazel since 1920 and Professor Carpenter since 1920.

PROFESSORS RETIRE

Ernest H. Freeman Robert V. Perry Arthur H. Carpenter

THE BOOK SHELF

*A Scientific Humanist. *Science and Criticism: The Humanistic Tradition in Contemporary Thought*, by Herbert J. Muller, New Haven: Yale University Press, 1943. $3.75.

The profession of literary scholarship in which I was trained is, on the whole, not only shockingly ignorant of science but stubbornly devoted to talking about the "higher values" of literature without bothering to specify, except in moralistic or metaphysical terms what is meant by "higher." The customary apologetics that purport to explain the relationship of literature to other human activities all too frequently reiterate charges against "scientific materialism" that might have been true a hundred years ago, but are no longer true today. (When literary scholars talk about science they are usually thinking of a freshman chemistry course they once were compelled to take decades ago.) Literature, they say in a hundred different ways, is above "mere" practicality—and in so saying, they only strengthen Veblen's sarcastic charge that the attitudes of scholars in *litterae humaniores* are chiefly determined by snob values of the leisure class. Literary scholars, and even literary critics, are usually unable to state the case for literature except in sentimental, dogmatic, or transcendental terms.

On the other hand, it is the contention of some literary scholars, unfortunately still a small minority, that both literary theory and the public understanding of literature will be immeasureably strengthened when literary scholars cease sniping at science and "materialism" and begin to learn what science can offer that can help us to understand the functions of literature. In *Science and Criticism* Professor Herbert J. Muller of the English department of Purdue University, has placed himself in the vanguard of that minority. His book, therefore, is one of great importance, not only to literary theorists, but also to all readers who, tired both of academic dogmatisms and of women's club sentimentalities about the relationship of literature to life, want a statement on the subject that a tough-minded empiricist can treat seriously.

The finest thing in Professor Muller's book is his survey of a dozen or more fields of modern and speculative science in the light of the question, "What is there here that a literary critic ought to know? What does this this scientist say that illuminates the works of literature or the controversies of critics?" To perform such a task obviously one needs to know not only a great deal about literature and literary criticism, but also a great deal about science. His knowledge of literature is, of course, extremely competent; his knowledge of science is likewise impressive. Many scientists know a great deal more about specific fields than Professor Muller, but only a few of the very best scientists, I am sure, have so clear a grasp of science as a whole, including its moral philosophical, and humanistic implications.

The intelligent reader, curious to know what post-Einsteinian physics, modern psychoanalytic theories, the non-aristotelian system of Korzybski, the biological theories of Trigant Burrow, the physiological psychology of Burridge, the theories of the Gestaltists such as Lewin and Koffka, the findings of modern anthropology, and all the other exciting new fields of science mean to us as moral and purposive beings, will find in Professor Muller's book an intelligible and indispensable guide.

In evaluating the moral implications of science, he first calls attention to scientific activity itself as a moral example: "In no other human activity is a higher premium placed upon truthfulness, or is the ideal of truthfulness more fully realized. . . . Outside his profession, needless to add, the scientist is no paragon of selfless virtue and wisdom. . . . Yet the scientific community as a whole is the most impressive example history has yet known of a disinterested, cooperative enterprise, international in scope, directed toward impersonal ends and by impersonal standards.* It is the most impressive demonstration of the actual possibility of supra-personal, supra-partisan, supra-racial standards and values."

In reviewing modern biology, which no less than other sciences has rid itself of the cruder dogmatisms of an earlier day, Professor Muller emphasizes the conclusion arrived at by such leaders as W. C. Allee that ideals of altruism and human solidarity, far from being sentimental nonsense, are grounded in biological necessity. Coming to psychology, he shows how the theories of the Gestalt school give promise of scientific contributions to esthetics that, unlike the explanations of narrowly mechanical psychologies, estheticians themselves may welcome without sacrifice of their faith in intuitive artistic perception and enjoyment. In a section entitled "Literary Criticism in the World of Einstein," he shows how modern science, while able neither to "identify values with any essential, ultimate reality," nor to "make them inhere in anything but human experience on this earth," nevertheless has "removed the grounds for disparaging them as subjective and therefore illusory." The "innate moral sense," which for centuries has been given a supernatural explanation, and its modern counterpart, "the inner check," which Paul Elmer More and Irving Babbitt also found impossible to be accounted for in naturalistic terms, are being accounted for by modern physiologists, such as Judson Herrick, who "conceive intelligence, abstraction, idealization, and all these higher activities as part of the biological mechanism of control; if they do not completely explain this mechanism, at least they do not make a needless mystery of it or split us in two."

Muller is not uncritical of scientists by any means. Many scientists, especially technologists, are just as closely imprisoned in the matter-mind dichotomy and the two-valued casuality of nineteenth century "materialism" as are the Norman Foersters and the Mortimer Adlers. Muller knows that science-as-dogma is as dangerous (and shallow) as metaphysics-as-dogma. But he repeatedly stresses the important point, that modern science, which has begun the scientific analysis of scientific activity itself and has ruthlessly analyzed its

(Continued on page 58)

*Reprinted from *ETC.: A Review of General Semantics*, Vol. I. No. 2 (Winter, 1943-44).

FROM YEAR TO YEAR

A RECORD OF OUR ALUMNI AROUND THE WORLD

MAN OF THE MONTH

ARTHUR CURTIS

A trustee and a loyal supporter of the Illinois Institute of Technology is the man-of-the-month selection for this issue. When George Sokolsky, the New York columnist, wrote up Arthur Curtis in one of his syndicated editorials, he led off with this statement: "At the Des Moines station I met A. J. R. Curtis. You are liable to meet him anywhere. We breakfasted and talked safety." A little further along Mr. Sokolsky says "He asked me to lunch—no tearoom fripperies but a real man's lunch with the roast beef rare."

Not so strangely perhaps, it was Art Curtis' eating habits that first brought him to the notice of the student body back in '04 when he contrived a method by which one could double the food for his money in the Lewis lunch room. (Imagine what a following he could acquire among the students today.) Space forbids telling more of Arthur's exploits the Lewis crowd might care to remember. It is relevant to add that he was made editor of the Annual in '08 and president of the engineering cass of '10. He was also president of the college dramatic club, the Lewis Engineering Society and the Parnassian Society.

Art Curtis was born near Humboldt Park, on the northwest side of Chicago in the days of horse cars and the Haymarket Riot and before there was much paving out that way. Neighbors kept horses, a cow and a pig, as well as goats, ducks and chickens. The argument in the family concerning his name resulted finally in a compromise in which the Curtis hopeful of 1887 got all of the names suggested. He still owns up to four names.

His father was John Crosby Curtis, a Civil War soldier of old New England stock and his mother Marion Ramage, daughter of a Canadian family that emigrated to Illinois in 1865. His two sisters were victims of diphtheria in childhood and when he was 8 years old his father died. At the age of 5 he was extricated from the under side of one of the city's first electric street cars, making its first trip on North Avenue. The marvels he beheld on the under side of the car so interested him that he eventually decided on a technical career and entered Lewis as soon as he was able.

Art Curtis went with the Universal Portland Cement Company first in research work and later in market promotion. His early association with the farm animals mentioned above may have led to his selection to develop the farm markets for cement in which his work was soon conspicuous. He served as president of the American Society of Agricultural Engineers in 1922. He wrote much of the plan under which the Portland Cement Association was reorganized in 1916 to become one of the country's largest and most sucessful trade organizations. He has been assistant to General Manager "Bill" Kinney (Lewis M. E. '06) since 1927, in which capacity he had headed the outstanding work of the Portland Cement Industry in the fields of safety, occupational health, insurance and industrial training. After a decade of this work under his leadership cement mill accidents were only 5 per cent as numerous as during the year before he "took over."

Art is a member of the executive Board of the National Safety Council, a leading member of the American Industrial Hygiene Association, one of the organizers of the Industrial Hygiene Foundation, secretary of the Committee on Accident Prevention and Insurance of the Cement Association and a member of numerous industrial and technical groups and committees. He prepared the courses used and acted as inspector of government concrete schools during World War I.

Arthur Curtis married Estelle Scherling in 1913. They made their home in Oak Park until 1927 since which time they have lived in River Forest. They have three children. Arthur R. (Beloit '37, Yale Law School '40), Herbert J. (Yale '39) and Jane, who is a senior at the Oak Park-River Forest High School. They also have a granddaughter, Susan Jane, daughter of Mr. and Mrs. Arthur R. Curtis.

Mr. Curtis is a past president of the Lewis Alumni. He was a member of the Board of Managers of Lewis and has been on the Board of Trustees of I.I.T. since its organization.

WITH OUR ALUMNI
IN THE SERVICE

1927

According to a recent report, LeRoy P. Martens, C.E., A., formerly of 715 Central Avenue, Wilmette, Illinois, has been promoted to the rank of Major at Selman Field, Monroe, Louisiana. Selman Field is the largest aerial navigation school in the AAF Central Flying Training Command. Major Martens after graduating from Armour, did post graduate work at Northwestern University, Evanston, Illinois. Prior to entering the service he was employed as Assistant Civil Engineer of the Sanitary District of Chicago.

Major Leroy P. Martens

1929

Rohr, Elwin K., F.P.E., A., a Corporal in the United States Army Air Force recently wrote to the Alumni Office:

"Your letter of June 21, was received a few days ago. The reason it was not answered immediately was that I had a picture of myself in process of being developed and wanted to enclose a print in my letter of reply.

No doubt it is too late for the purpose you had in mind but I am sending you a print for future use as an occasion may arise. A word of explanation is in order for the delay in starting a picture to you.

In the first place this is the monsoon season over here. The blue sky and sunshine are seldom to be seen. On top of that the facilities for developing and printing are very poor and slow. It took about two weeks to get my last roll of film processed.

In your letter you wondered why it was badly cut. The censorship regulations here are very strict. Although I gave no important military information, they probably cut out the part where I told something of my work.

Would you please have all alumni publications sent to me from I.I.T. It would be nice to hear from you again soon and let me wish you success in your new work.

(Signed) Edwin K. Rohr, Cpl.—32473169
14th Transport APO No. 627
New York City, New York."

Corp. Edwin K. Rohr

1939

Professor John J. Schommer again was the recipient of this very interesting letter from somewhere in India:

"Greetings:

Only yesterday your V-mail arrived, forwarded from my home. It was nice receiving it. Sort of lifted me up and transported me half way around the world again and refreshened a bit my memories of old Armour. I wonder how many thousands of your letters have reached men scattered all over the world. Quite a few of the men are in this theatre, occasionally I'll meet one.

All of us will bring home many thoughts and ideas materially different than when we left the States. And the tales we will tell, like those of every other war, will grow in the telling. So far my biggest moment was being the flight engineer on the first B-29 to hit Japan. It seemed proper as I was in the first flight engineer's class to be graduated from the Army.

Sometimes I feel quite fortunate that in the Army I was put in a position where my education, in an engineering line, could continue. We, at Armour, had no Aeronautical Engineering Course. I do not know how it is now, but I, in company with a great many other engineers, now know a great deal about operation, planning, handling and maintenance of aircraft and engines. Items that only constant living and flying those big planes could teach in the space of only a couple of years. When this war is over, a great many of us would like to continue our education along those lines and be engaged in that industry.

At present, in addition to my crew duties, I'm the Squadron Flight Engineer. For awhile, back in the States, when I was one of but a half-dozen flight engineers in the Air Force, I did considerable teaching—though I did not care for the job. Have also been instrumental in a few technical developments which gratified me much more.

Thanks again for the letter and regards to all my old profs.

Sincerely,
Edward Morris, 1st Lt. A-C
M.E., A'39
0-855797
677 Bomb Sq., 444 Bomb Gp.
A.P.O. 215 c/o Postmaster
New York City, New York."

1937

Kendall, Nat. S., C.E., A., a Lieutenant (jg) in the United States Naval Reserve recently wrote this interesting letter to Professor John Schommer:

"Dear Uncle John:

Anyone who writes a letter like I received today sure becomes a "Dutch Uncle" and, while it is most encouraging to say the least, I believe you have undertaken a big job. But that is not new for you to do.

Several months ago when I was in the Solomon Islands I saw a News Reel in which you congratulated Mr. Stagg. Your method was most unique and one that I know you meant sincerely. It was quite a thrill to see someone I knew even if it was months old.

After spending nearly a year in the Solomons, I have moved over to the Admiralty Islands. Why the Navy lets us tell where we are I do not know but that is the policy so I am not giving away any military information. I can tell you this though and that is that all of the Islands are alike and after you have seen one you have seen all of them. The native gals are a little different, but even that gets a little tiresome.

The work that we have done out here has gotten a lot of publicity. I am proud to say that in most cases we have done a good job, and that a lot of credit goes to the older men in our Battalions who have come into the service and done more than their share when a great many of them would never have had to be in the service.

The most of our men are tradesmen of one kind or another and you would be surprised to see the many jobs that they have been able to do under handicaps that are indescribable. It will give all of us something to talk about when we get back.

I was certainly sorry to hear of Mr. Allgiers passing and have had several letters from Mrs. Kucera. Mother Allgier is none too well, and yet I am sure she will pull out of it and be like her old self again.

You will have to excuse the many mistakes, but the Navy has not gotten around to giving us steno service. I want you to know how much I appreciate getting your letter and if the need be I will be around and give you a chance to fill your promise.

May I wish you good luck in your work and will you please give my regards to all there at school. With best personal regards

(Signed) N. S. Kendall, Lt., USNR CEC
58th Const. Batt.
Fleet Post Office
San Francisco, California."

1940

John Schommer scores again. We wish it were possible to publish all of the letters received by him from Service Men all over the world, but that is an impossibility. This one was received from Vern J. Hassell, F.P.E., A., and we are sure you will find it very interesting reading material:

"Dear John:

Received your alumnus V-mail quite some time ago and was more than pleased to know that I hadn't been lost in your undoubtedly vast file. Also a real morale booster to know that someone back there at old IIT is thinking of us.

Spring came over here in Merry (?) old England also, but it wasn't quite recognizable to we Yanks. Summer is here now, so they tell us, but we continue to go about in woolens, jackets, and sleep under a couple of blankets with no discomforts.

As far as the preponderance of window gazers on State Street being women, isn't that always true?

Haven't really been able to call Chicago home since graduation in '40, but have every intention of doing so after this is all over. Have heard about the marvelous things going on at IIT, and one of the first on my list is to get down and take a look around.

News of the war on all fronts is very heartening these days and naturally a lot of talk turns to how soon we'll all be home. Everybody has their own reason for wanting to get there and mine is a family and home. Have been given to understand that my prewar job is waiting, but not having pinned my conscience down to anything, will undoubtedly be in to pay you and the Placement Department a visit sometime.

Sincerely yours,
(Signed) Vern J. Hassell
Lieut.—0965314
155 P. R. Sq., APO 141
c/o Postmaster
New York City, New York."

IT HAPPENED AT ILLINOIS TECH

in 1943

In the daily life at a large college, one day follows another without much departure from the business of classroom and lab routine. Things go on apace, however, behind the scenes. Some we learn about as we go, others take place under the veil of scientific secrecy. But, when viewed in retrospect, the accomplishments of a year's work assume huge proportions. . . . In a war year like '43, civilian training and military training, too, are seen in their proper relationship to the needs of the times. . . . We have set down here some of the accomplishments of the college in 1943. As the days following graduation pass into years, you may want to know "What did my college do in the war year of 1943." This page will be an interesting reminder.

TRAINING ENGINEERS AND SCIENTISTS. To help alleviate the acute shortage of men and women in all branches of engineering and science, whether in civilian or military activity, Illinois Institute of Technology carried on its regular courses, graduating a total of 437 men and 47 women.

ROUND-THE-CALENDAR EDUCATION. In July, 1943, Illinois Tech went on the accelerated plan of three 16-week terms. Students of 1943 will recall Thanksgiving as just another day in classrooms. Those with early classes will remember how the first class started at 7:30 a.m. instead of 8:10 a.m.

CHICAGO SUN PHOTO

DEVELOPMENT PROGRAM. On January 11, 1943, the quarter-million dollar Metals and Minerals Research Building for the Armour Research Foundation, the first unit in the $3,100,000 campus development project was dedicated. The illustration here is of President Heald participating in the dedication ceremony. Construction has been started, and is now nearing completion on the Automotive Research Laboratory Building for the Armour Research Foundation and on the Parmly Foundation for Auditory Research Building.

BLOOD DONATING RECORD. Illinois Tech was the first college in this area to donate sufficient blood for the Red Cross Mobile Unit to visit, not once but three times in '43! 381 pints were donated in three days during the first visit . . . the most given in three days up to that time to a Mobile Unit. Again in August, 512 pints set a still higher record. A total of 1138 pints of blood was donated by the students during 1943.

CHICAGO TRIBUNE PHOTO

RESEARCH. The very nature of this work under war time restrictions veils itself in secrecy. The veil can only be lifted after the war is over. More than 30 different projects, however, are under way at Illinois Tech.

In 1943 the erection of the wind tunnel was completed. The electron microscope, a rare, scientific instrument, became available. It is the only one in the Chicago area, the 34th in the nation, and the 41st in the world.

STUDENT WAR COUNCIL. Organized in January, 1942. Carried on the good work through 1943, becoming very active in the salvage drive. Assumed full responsibility for posting of Air Raid notices around the schools. Assisted in rationing negotiations in a suburban school district where an insufficient number of teachers was available for this purpose.

WAR TRAINING PROGRAM. In 1943 Illinois Tech retained its position of operating the largest war training program (ESMWT) in a single city in America. Forty-two thousand persons have been enrolled up to December 31, 1943. Thirty-four thousand since Pearl Harbor . . . 22,574 this year. In 1943 the emphasis changed to In-Plant courses. More than thirty plants now have such schools operated by Illinois Tech. The fulltime pre-employment courses for women also reached their peak in 1943. The illustration here is of the 1000th woman graduating from these courses. More than 1100 women have been trained as war technicians by Illinois Institute of Technology, of which 563 graduated in 1943.

LOOP PHOTO

SIGNAL CORPS TRAINING SCHOOL. At the request of the United States Signal Corps, this program was inaugurated in 1942 and carried through to completion in 1943. 4,316 students in pre-radar were trained. To provide classrooms equipped for the purpose, Illinois Tech took over a garage building, called it Pre-Radar Hall, and leased the Northern Illinois College of Optometry. The school was closed July 31 when the student instruction in this course was completed.

EXPLOSIVES SAFETY SCHOOL. Formally known as the "School for Safety Auditors," this school was established in August, 1942, at the request of the Office of the Chief of Ordnance, War Department. Illinois Tech was selected to organize and administer this school for two reasons: (1) its outstanding war training record (2) its work in conducting the nation's only Department of Fire Protection Engineering. The instruction carried on through 1943, training munitions experts to take places in varying capacities in 600-odd munitions plants. Students in this school are specially selected by the Army and Civil Service. Of the total of 366 trained, 251 graduated in 1943.

LOOP PHOTO

STUDENTS IN UNIFORM. Both the Army (ASTP) and Navy (V-12) came to Illinois Tech in 1943. Thus, Illinois Tech became one of a few colleges with both Army and Navy men in the student body. Approximately 700 Navy men and 500 Army cadets attended Illinois Tech at all times. The Navy men were a part of regular college activities, while the soldiers attended classes conducted exclusively for them.

Illinois Tech

CONSOLIDATION OF ARMOUR AND LEWIS INSTITUTES

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Among the first pieces of equipment to land on island beach-heads, they have helped beat the Japs to the punch time after time.

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quickly provided a vitally needed method of converting alternating current—one of the keys to mass production of aluminum that made possible U. S. air supremacy.

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Multiple V-Belt Drives, invented by Allis-Chalmers, drive 75% of *all* U.S.A.'s war production machinery—speed a gigantic flow of planes, tanks and guns to U. S. troops!

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But after Victory, the same knowledge and ourcefulness that have engineered over 1600 different industrial and farm products will be ready to tackle your peacetime problems . . . to provide gas turbines, electronic devices, many other new types of equipment to meet your specific post-war needs.

VICTORY NEWS

Gas Turbines Take Up To 50% Less Space: Plans for a 5000 HP locomotive powered by 2 complete gas turbines have already been drawn up by Allis-Chalmers. Because of simple, compact construction, these turbines require just *half the space* needed by conventional engines—deliver their power with unusual economy.

Engineers predict widespread use of these revolutionary new A-C Gas Turbines in ships, planes, locomotives and other machines.

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This "Unit Sub Builder" set eliminates guesswork—means far more accurate calculations. No bogging down in charts, diagrams or tables. Call your nearby Allis-Chalmers District Office for full details.

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SEVERSON, ELEANORE M., of the Army Nurse Corps, H.E., L., write the following interesting letter from Tonopah, Nevada.

"Dear Miss MacLuckie:

I am now in the desert wastelands of Nevada at the Tonopah Army Air Field, Tonopah. The camp is so isolated that often I feel I am doing foreign duty right here in the U. S.

Our hospital is growing rapidly, which keeps us nurses and doctors very busy. I do wish that I'd go overseas, but I suppose I'll have to be satisfied with duty in this place.

Would you please place my new address on the mailing list? I am

Your old H.Ec. friend,
(Signed) LT. ELEANORE M. SEVERSON
A.N.C. N789064
Station Hospital
T.A.A.F.
Tonopah, Nevada."

1941

A most interesting letter was received by the Alumni Office written by VICTOR H. DRYER, E.E., L., who has returned to this country after serving over a year with the Amphibious Forces in the European Theater. The letter reads as follows:

"Having but recently received the May and June issues of the "Technometer," I was reminded that it has been several months since my address has been changed on your records. Please send future publications and correspondence to the following address until further notice:

LT. (j.g.) HENRY V. DRYER, USNR
Room 104, Michigan Union
Ann Arbor, Michigan

These last two issues must have traveled all the way to the Mediterranean and back to finally catch up with me here.

My present assignment is as a student of "Naval Architecture and Engineering," at the University of Michigan under the supervision of the Post Graduate School, U. S. Naval Academy. My wife and I are residing at the above address pending completion of the course.

Referring to Lt. (j.g.) Short's letter (May Technometer). I can't say that I find myself as enthusiastic about the beauties of the "Med" as he. After having spent over a year in that area as a member of the Amphibians Forces, there's nothing that can beat the scenery of the U.S.A., in my opinion. After such a long absence my first sight of the United States was from the window of a Navy transport plane. Back again over the land I had sometimes wondered if I would ever see again. There was considerable evidence of winter visible, the fields were gray, the trees leafless. That rolling carpet of fields, trees, streams, highways, and whole towns was one of the most beautiful sights of my life.

It was HOME, all of it, every inch of it. It may not be grand, or majestic, or breathtaking to those who see it every day, but to me it was beyond the power of description.

Yes, the "Med" has its lovely aspects. There are times when it is a beautiful blue, unruffled sea, times when the mountains of Africa, Sicily, or Italy blend with sky and sea to verify the pictures in guidebooks. But the "Med", just like any other sea, has a variety of moods. It has gales and tumultuous seas that cause even the larger ships to pitch and roll heavily; storms when all but a lucky unaffected *few* feel no need for food. There is lovely scenery, too, but the picturesque Arab towns can be recognized by their stench from miles off at sea with an offshore wind; that hot blasting "sirocco" which originates somewhere in the desert and sweeps northward across the sea. Many a night the glow of Vesuvious has beckoned all comers to Naples—yet it has spread destruction as well. In winter Italy's snow-capped mountains and green shoreline are a sight to see—*from a distance*. Our GIs only cursed them. Almost everywhere on the shores of this ageless sea, one will come across ruins of by-gone civilization (to say nothing of contemporary devastations). The peace of this sea has been shattered numerous times by the battles of mankind as well as the upheavals of nature. Its skies are not strange to the black-crossed "bandits" who wing across them. Its beaches have known the full meaning of "H-Hour, D-Day." Its towns have felt the blast of pounding by bombs and shells.

As the British would say, I had no regrets at leaving the "bloody Med."

(Signed) HENRY V. DRYER
E.E. '41."

WOOD, JOHN K., F.P.E., L., a Lieutenant (jg) in the United States Navy has been reported missing in action since May 15, 1944. As yet no further news has been reported.

1942

From somewhere in the New Hebrides, this letter was received by Uncle John from WILLIAM F. VIZARD, E.E., L., a Lieutenant in the United States Naval Reserve.

"Received your V-mail the other day and to say it was most welcome would be a vast understatement. You know, Mr. Schommer, I think you missed your calling. The way you throw the King's English around you could be making a fortune writing books instead of beating your head to a pulp trying to get a fieldhouse out of the administration.

The building program sounds swell, but as long as there is a South wind on a hot day it will still be the same old place. You know Dame Rumor has it out here that the campus is going to be graced with a fieldhouse for certain this time. That is, of course, if a certain few people can be gently persuaded some dark night.

In order to fill up space and because for some strange reason you might be interested, I'll give you a brief resume of my dark and sordid past since leaving the confines of Scarlet and Gray. After graduation I was ordered to Fort Schuyler for Indoctrination. The Navy then saw fit to send me to Bowdoin College, M.I.T., and Corpus Christi for Radar training. Then somebody who must have taken a violent dislike to me, sent me to Argus. Our outfit left the States a year ago last August. We messed around in the South Pacific for quite some time before we saw any action. We finally went in on the Green Island push, which ended the Solomons Campaign. We had a little excitement going in and for the first few nights but after that they left us alone. There were only a couple of hundred Japs on the island and the only one I saw was in the cockpit of a plane that tried to dive bomb us. After ten months of living in tents and mud, I have finally landed a relatively soft job. I am now with a field overhaul unit and have charge of the radio, radar, and electrical shop with about thirty men in it . . . add to this my own jeep, damned interesting work, and good quarters and you've got my idea of a good set-up. As for when I'll get back, only God and the Navy know that. I haven't been to church lately and the Navy won't break radio silence.

All errors in this masterpiece of English prose are due to a broken down typewriter, no secretary, and the fact that someone said an engineer couldn't write.

So long for now, and don't work too ha d.

Sincerely,
(Signed) BILL VIZARD
F.O.B.—3 Navy 140
Fleet Post Office
San Francisco, California."

ENSIGN HENRY C. HOOVER, JR.

1943

HOOVER, JR., HENRY C., C.E., L., graduated from the Naval Air Training Center, Corpus Christi, and was commissioned an Ensign in the United States Naval Reserve on August 5, 1944. Ensign Hoover's parents reside at 1581 Henry, Des Plaines, Illinois.

The following News Release was received by the Alumni Office from the Public Relations Office, Ninth Naval District Headquarters, Great Lakes, Illinois.

"Great Lakes, Ill., Aug. 14.—KENNETH H. JACOBS, M.E., L., of 1017 North Leamington Avenue, Chicago, Illinois, will graduate from basic indoctrination tomorrow as honor man of his company at the U. S. Naval Training Center here and will go on recruit leave.

Jacobs was elected candidate by fellow bluejackets and selected honor man by his company commander on the basis of military aptitude and progress. He has been recommended to attend pre-Radio School for further training.

Prior to joining the Navy he was employed as a mechanical engineer by the Holley Aircraft Carburetor Company, of Detroit, Michigan. He is a graduate of the Illinois Institute of Technology of Chicago with a bachelor of science degree in mechanical engineering.

He will spend his leave with his wife in Chicago.

KENNETH H. JACOBS

LEVALLY, JOHN R., M.E. A., recently sent to the Alumni Office the following excerpt from a letter written on June 9th by his son, Ensign JOHN R. LEVALLY, JR., M.E. '43, now serving on a destroyer off Italy. Regarding the letter, the father commented that it illustrates "why the Axis hasn't a chance to lick these boys of ours with their sense of humor." The excerpt follows:

We have a good automatic juke box which we can hook up to the ship's broadcasting system. A great many of the guys have tastes like mine, so we are strong on boogie and records with a solid beat.

We had just hooked up the speaker topside and had just put on 12 good records and 30 or 40 of the crew were listening to the music. Well, there we were, steaming around the harbor, Benny Goodman's "Sing, Sing, Sing" going full blast (you could hear it in Sardina) when they came out of the sun.

There was a mad scramble for guns and helmets and the German planes tore into us—the record still playing full volume. What a madhouse! Gene Krupa's drum solo, plus 1,000 pound bomb bursts. Well, anyhow, we blasted three of them, but we had a tight squeeze. Never missed a beat. It was all over before the fifth record started. This was about the 70th bombing for the crew and they are still kidding. I guess the country will be in good hands when these kids get home."

Testing Mica Sheets

Mica's special insulating qualities are mighty important in communications equipment. No equivalent exists, so war's huge demands caused a critical shortage.

Bell Telephone Laboratories' scientists were assigned the task of somehow finding more mica. They found it—in the very considerable amounts of raw mica which visual inspection had rejected. By developing electrical apparatus to test the two most important electrical properties, they increased the usable amount of mica by half and so stretched current supplies of mica to fill all military needs.

In many such ways the Bell System is serving the nation, constantly meeting the needs of our fighting forces for dependable communications.

BELL TELEPHONE SYSTEM

"Service to the Nation in Peace and War"

WITH THE CLASSES

1899

ADAMS, FRANKLIN P., Arch. A., of "Information Please" fame paid a visit to Illinois Institute of Technology last August. He was accompanied by Robert L. Wishnick, Ch.E.'14, a member of the Board of Trustees, from New York City. Mr. Adams is now running on the Democratic ticket for a seat in the Connecticut legislature.

1903

LITTEN, FREDERIC N., Ac. L., name has been in the newspapers frequently the last few weeks in connection with the Midwest Writer's Conference which was held at Northwestern University. In Fanny Butcher's column, she speaks of him as "Frederic N. Litten, the popular teacher, who now has charge of all fiction writing at the Medill School of Journalism." Besides teaching at Northwestern University he turns out one book a year for boys. His residence address is 402 Prospect Avenue, Lake Bluff, Illinois.

1906

The following News Release was received by the Alumni Office about RICHARD O. HELWIG, M.E. L., and reads as follows:

Alumnus Richard O. Helwig, (Lewis '06) of Square Post No. 232 The American Legion has been named First Chairman of the newly-organized Oak Woods Cemetery Division of The Grand Army of the Republic Memorial Association.

The Division composed of United Spanish War Veterans, Veterans of Foreign Wars, The American Legion, and the Auxiliaries of those organizations, Sons and daughters of Union Veterans, The Women's Relief Corps, have for their primary purpose, the flagging of graves and holding memorial seervices.

Oak Woods Cemetery has some 8,000 graves of all soldier dead and nearly 6,000 Confederate soldiers lie buried there. It is the largest Civil Military Cemetery in the world.

1908

Word has been received of the death of FLANDERS, PAUL A., Ac. L., who recently moved from Carmel, California, to San Francisco, California. He was a Lieut.-Commander in the United States Navy.

1914

WARD, FRED L., M.E. A., a lumber and building material merchant, Second Avenue and Boone Street, Marshalltown, Iowa, also is publisher of "The Builder," a monthly paper.

1917

GIVEN, LOUIS E. E.E. A., writes he is with the Given Brothers Shoe Company, P.O. Box 206, El Paso, Texas, and resides at 1100 N. Stanton Street, El Paso.

1919

WILSON, MELVILLE M., Ch.E. A., has been appointed to the position of Sales Manager of R-B-H Dispersions, Incorporated of New York City. Mr. Wilson was engaged four years ago in a technical and sales capacity by Interchemical Corporation, of which R-B-H is a subsidiary. Mr. Wilson's first position was with the development branch of the Western Electric Company in Chicago. He was associated with Sharples Chemicals, Philadelphia, for ten years, where one of his major projects was the development of amyl compounds. Later he became a partner of American Lacquer Solvents, at Phoenixville, Pennsylvania.

1920

Representative FRED E. BUSBEY, C.E. A., Republican of Illinois, recently gave a talk on "Americanism" at a luncheon meeting of the Arlington Republican Women's Council, Washington, D. C. Educated at Armour Institute of Technology and Northwestern University, the Representative is a member of the Dies Committee and has given many lectures on the dangers of the drift away from constitutional government by the New Deal. Because of his twenty-two years of service in the American Legion and Veterans of Foreign Wars, Representative Busbey was also made a member of the World War Veterans' Legislative Committee, which will be responsible for handling legislation pertaining to service men and

1921

SCHOENING, JOHN A., Arch. A., who for the last ten years has been employed by Harold Spitznagel, Architect, of the National Bank of South Dakota Building, 100 N. Phillips Avenue, Sioux Falls, South Dakota, but who has recently been engaged in the government's building program, is now an associate member of the firm.

Mr. Schoening, a licensed architect in Illinois, was recently granted a license to practice in South Dakota.

1923

PRENTISS, EDWARD W., C.E. A., who is Assistant Engineer of Bridges and Buildings, The Pennsylvania Railroad, Western Region, resides at 5959 N. Kenmore Avenue, Apt. 205, Chicago 40, Illinois.

1925

A flexible lifelike plastic, tinted to blend exactly with any skin pigmentation, has been developed by Dr. STANLEY D. TYLMAN, A.S. L., University of Illinois dental college professor, as an immediate replacement for missing noses, ears, fingers, and other parts of the human body. The new material, described as more lifelike than any ever used before, was perfected after more than three years of research by Dr. Tylman and his staff. Medical officers of the army and navy are investigating the possibility of using the plastic as a mass restorative for maimed service men.

The material has a texture similar to skin, a tissuelike flexibility, and a lifelike translucency. It can be permanently colored to blend with the coloring of an individual and finished to a paper edge to hide the union with living tissue. The new plastic restorations can be made to serve the functional purpose of the parts they replace. The plastic replacement has also proved valuable as a guide to surgeons in planning plastic surgery. This article was taken from the Chicago Daily Tribune of August 9, 1944.

1926

LARSON, DAVID E., F.P.E. A., who has been an engineer and special agent in the service department of the Home Insurance Company of Chicago, has been promoted to the position of state agent in Illinois outside of Cook County for the Home Fleet, it was announced on July 12th, by Louis J. Fischer, General Manager in Chicago. Mr. Larson has served ten years with the Home Fleet. This article was taken from the Chicago Daily News.

SHAFFER, GRANT A., E.E. A., was recently appointed Sales Manager in charge of the Jobber Division for Stancor, New York City, New York.

1927

FLEISCHER, JOSEPH, E.E. A., wrote the following V-mail letter to John Schommer in answer to his V-mail letter.

Dear Friend John:

Received your letter dated June, 1944, that begins "Just a sweet breeze—" and was delighted with contents. I am now in France and in the middle of the whole damn war. This is not a country of silk stockings and beautiful women, but rather ruin and desolation. However, in spite of man and his wars the apple trees continue to grow apples and the grass continues green. I am well, the food is exceptionally good considering the circumstances but cannot be happy until this war is over. Then some day I will stop in and swap stories with you. I have some swell ones and you no doubt can reciprocate.

Please note latest correct return address. Your letter was forwarded 4 times and has made fine time in arriving here. We are busy every minute of the day and night and try to get a few hours sleep until Jerry comes over. Last night I talked about good old Armour to some of the officers and wish I was there.

Sincerely,
(Signed) JOSEPH FLEISCHER—0304042
HQ 89th QM BN Mobile (TC)
APO No. 350
New York City, New York.

HELMAN, IRWIN H., A.A. L., has recently moved from Chicago to Iowa. He may be reached at 106 S. Iowa Street, Washington, Iowa.

The National Underwriter for July 6th, 1944, had the following paragraph about WILTON F. KUFFEL, F.P.E. A.

Kuffel joins A. F. Shaw Agency In Chicago. W. F. Kuffel has resigned as assistant manager at Chicago for Phoenix of Hartford to join the A. F. Shaw & Co. agency here. He is prominent in fire insurance affairs in the city. He joined Phoenix in 1937 after having served as an engineer for the Chicago Board for 12 years. He has served for several years as president of the Insurance Club of Chicago.

1928

HOWARD, CARL G., A.S. L., who has been with Fansteel Metallurgical Corporation, North Chicago, Illinois, for the past eighteen years in engineering and sales management of electrical products, recently started his own sales organization. His business address is Manufacturer's Representative, 205 W. Wacker Drive, Chicago 6, Illinois, and his residence address is 2271 Lakeside Place, Highland Park, Illinois.

JOHNSON, EARL K., F.P.E. A., is now a Lieutenant in the United States Navy. His residence address is 403 High Street, Cranford, New Jersey.

Rev. WILLIAM D. MCLEAN, JR., A.S. L., recently moved from Washington to Butler, Pennsylvania. His new address is 607 N. Main Street.

1929

STELLAR, RAYMOND F., C.E. A., resides at 3701 Massachusetts Avenue, N.W., Washington, D. C.

1930

BRAY, DON R., F.P.E. A., has been appointed manager of the Wayne County department of Corroon & Reynolds at Detroit, Michigan. Mr. Bray was associated with the inspection bureau at Minneapolis for some time. He was with the Western Sprinkled Risk Association for several years, with headquarters at Detroit, and since the dissolution of the WSRA, has been with a fire insurance company in Wayne County, Michigan.

Lieutenant Commander JOHN W. HURLEY, C.E. A., is with the Navy Department Hydrographic Office, Washington 25, D. C.

MANSKE, WILLIAM R., C.E. A., who resides at 769 Elm Street, Denver, Colorado, recently wrote the Alumni Office as follows:

Since January 1st when I was transferred from our St. Louis Plant, I have not been receiving the Engineer and Alumnus and have been out of touch with the school entirely. I would greatly appreciate your reinstating my name on your mailing list, as I miss the publication and all its interesting news. I am now located at the American Manganese Steel Division of The American Brake Shoe & Foundry Company, 4th and Wazee Streets, Denver, Colorado, as Assistant Works Manager, and can really say Colorado and all its beauty is God's country. We are still producing 100 per cent war contracts for the U. S. engineers and like all other industries, are cry'ng for labor. Incidentally, if anv of the grads are not employed, or want an up and coming industry to affiliate with, I can highly recommend the steel foundry game. Never a dull moment.

Kindest regards to President Heald, Dean Tibbals, Professor Thompson and Colvert.

Sincerely yours,
(Signed) W. R. MANSKE.

WHEELAND, WILLIAM G., F.P.E. A., has been named State agent of the Automobile and the Standard Fire of Hartford in Indiana August 1st, 1944. Mr. Wheeland has been with the Automobile and the Standard Fire for the last four and a half years as an engineer and fieldman. He will maintain headquarters at 1216 Merchants Bank Building, 11 South Meridian Street, Indianapolis, Indiana.

1931

Lieutenant Colonel ALVIN B. AUERBACH'S, C.E. A., address is Hq. 1877 Engr. Avn. Bn., APO No. 493, care Postmaster, New York City, New York.

KESSELRING, PAUL H., F.P.E. A., formerly associated with the Michigan Inspection Bureau of Detroit, Michigan, is now a Lieutenant (j.g.) in the Security Office of the 12th Naval District.

1932

BILLS, GEORGE H., E.E. A., of the Staff and Faculty, Quartermaster School, Camp Lee, Virginia, was recently promoted to Major.

KING, THEODORE N. A.S. L., writes that he welcomes the regular copies of the Technometer and would like us to have his correct address.

It is Lt. Theodore N. King, 594 FA Bn., APO No. 93, care Postmaster, San Francisco, California.

KEEPING UP WITH

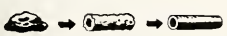
Electricity

SYNTHETIC FIREFLIES . . . New Westinghouse fluorescent marker lamp rivals the firefly in economy of light generation. Tiny lamp, consuming only 1/10th watt, will prevent mishaps on dark stairsteps. Unlike lightning bug, it can be kept glowing continuously—at practically no cost.

1/50,000,000th OUNCE . . . That's the weight of a single layer of oxygen atoms the size of an air-mail stamp. Westinghouse research engineers have built a delicate balance that measures the weight of such a microscopic layer of oxide on metal—to determine resistance of special alloys to high temperatures.

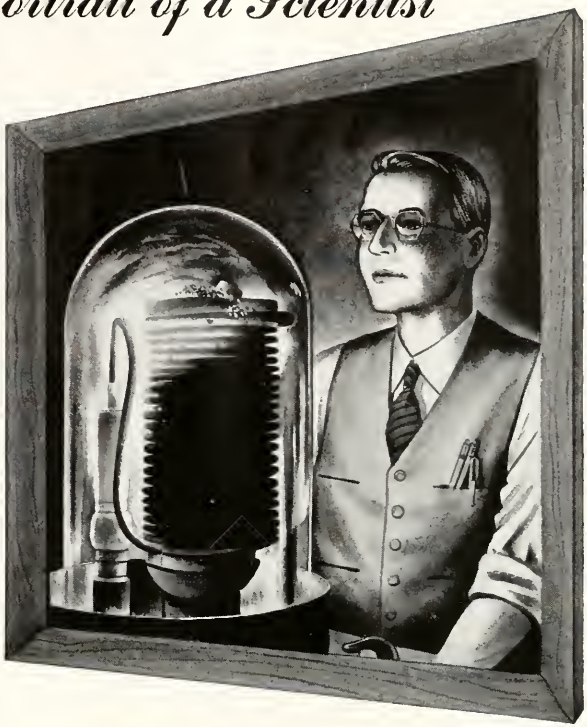
POWERHOUSE ON WHEELS . . . The retreating enemy knows that the quickest way to paralyze a city is to destroy its powerhouse. Advancing Allies know that the quickest way to restore order is to restore power. A 5000 KW power train, built by Westinghouse, moves in on railroad tracks, hooks up to power lines, starts boiler and generator . . . then lights come on, order emerges.

INSIDE STORY . . . Transparent Lucite bearings now permit research engineers to visualize performance of lubricating oil in bearings, subjected to varying operating speeds and pressures. Red pigment shows where oil goes and what it does.



PREFORMED PLASTICS . . . New Westinghouse process in plastics manufacture "beats" resins into cellulose fibre, then shapes mixture over perforated copper form. Plastic is peeled off and dried, then placed in heated mold and pressed into final shape. Saves time in making reinforced plastics of intricate shapes.

Portrait of a Scientist



creating a better yardstick for testing wartime metals

Spectrum analysis provides the *quickest* and *most* accurate method for checking the composition of metals used in making guns, planes, tanks and ships.

Iron has long been used as a *yardstick of comparison* in spectrography—because of the large number of lines in the iron spectrum.

Formerly, the best standard obtainable was *iron only 99.9 per cent pure*—containing impurities that produced confusing lines in spectrographic pictures.

Westinghouse research engineers tackled the difficult problem of producing a purer iron—a *better* yardstick for testing wartime metals.

They accomplished this by fusing the purest iron obtainable in a high-frequency induction furnace, surrounded by an atmosphere of hydrogen gas.

Result: iron 99.99 per cent pure—containing only 1 part metallic impurities in 10,000 parts of absolutely pure iron!

Today, this ultra-pure iron is "mass-produced" by Westinghouse at the rate of 1000 pounds per year—and is used in all parts of the anti-Axis world to improve the quality of war material.

A significant contribution, by Westinghouse, to industry at war and in the days of peace to come. *Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pa.*

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

WESTINGHOUSE PRESENTS John Charles Thomas, *Sunday* 2:30, *EWT*, NBC. Ted Malone, *Monday, Wednesday, Friday* 10:15 pm, *EWT*, Blue Network.

1933

Fishman, Henry Z., Ch.E. A., writes he recently changed his position and is now working for the General Luminescent Corporation, 638 S. Federal Street, Chicago, Illinois. His work involves engineering in the production of fluorescent cold cathode lighting tubes, the newest development in fluorescent lighting. Mr. Fishman resides at 1024 Hyde Park Boulevard, Chicago 15, Illinois.

Bush, Frank L., Arch. A., has been transferred to Inglewood, California, working as a tool engineer specializing in plastics. He enjoys his work very much and gives much thanks to I.I.T. for his success in the business world. His new address is 8257½ Crenshaw Drive, Inglewood, California.

1934

Flour, William, E.E. A., is now stationed somewhere in New Guinea.

Klima, Orville, M.E. A., who is employed by W. A. Jones Foundry & Machine Company, 4401 W. Roosevelt Road, Chicago 24, Illinois, resides at 210 S. Peck Avenue, LaGrance, Illinois.

Larsen, Henry A., C.E. A., is a salesman for The Western Shade Cloth Company, 32 Wells Street, Buffalo, New York. His mailing address is R.D. No. 1, Trucksville, Pennsylvania.

Lyle, Lawrence H., C.E. L., writes:

I am no longer at Camp Peary, Virginia, and have had a change of rank. My correct address is as follows:

Lt. (j.g.) Lawrence H. Lyle,
CEC V(S) USNR
70th Naval Construction Battalion
Advance Base Depot
Davisville, Rhode Island.

Sider, Norman L., A.S. L., a Sergeant in the United States Army writes that his military address has been changed to Post Judge Advocate Office, 1622 SU Service Company, Fort Sheridan, Illinois.

1935

The following letter was received from Walter I. Lerche, A.S. L., Skp. U.S.N.R., U.S.S. Ancon, Fleet Post Office, New York City, New York:

I received your V-mail letter of April 26, 1944, and am delighted to hear from the Alumni Association, as I've lost all contact with it for the past two years. The last contact being a dinner held at the Stevens on February 20, 1942. Shortly after which I left the city and have been away ever since.

I am interested in the progress and news of the school and will welcome any and all reports about it and the Alumni Association and any part I can play in its progress, now and on post-war period, just needs any suggestion from you.

Enclosed is a postal order as a starter to the Alumni Fund.

I am interested in plans for post-war curricula and placement assistance, so all information you can pass along ont in the field will be appreciated.

Sincerely,
(Signed) Walter I. Lerche, I.'35.

The following article was released by Public Relations Office, Columbus ASF Depot, Columbus, Ohio, August 2, 1944:

Columbus, Ohio, 2 Aug.—Second Lieutenant Daniel E. Moore, E.E. A., 1510 West 104th Street, Chicago, Illinois, has been promoted to the rank of First Lieutenant, according to a recent announcement by Col. S. I. Ziedner, commanding officer of the Columbus Army Service Forces Depot, Columbus, Ohio. Lt. Moore is Chief of the Expediting Section, Stock Control Division of the Engineer Supply Section at the Depot. Before receiving his commission in the Corps of Engineers in December, 1942, Lt. Moore was employed as cost estimator and production manager for the Chicago-Wilcox Manufacturing Company, Chicago, Illinois.

He has the degree of B.S. in E.E. from the Armour Institute of Technology and also attended Notre Dame University. He is a member of the Mantle Club.

Lt. Moore is the son of Mr. and Mrs. Daniel E. Moore, 1510 West 104th Street, Chicago, Illinois. Two brothers are serving in the European theater of operations, Captain Robert A. Moore, CE, and Tech. 5th Gr. Gerald C. Moore.

1936

The present mailing address for Captain, Corps of Engineers, Milton J. Bejcek, Arch. A., is Hq. 325th Engineer Combat Battalion, APO No. 447, Fort Bragg, North Carolina, where he is stationed after completion of Command and General Staff Course at Fort Leavenworth, Kansas.

Due to over-seas assignment, Major Maurice E. Clark's M.E. L., address has been changed to his residence address at 61 Chicago Avenue, Oak Park, Illinois. He formerly was stationed at Washington, D. C.

1937

Loftus, Jr., Martin J., M.E. A., a Lieutenant in the United States Coast Guard is stationed in Cleveland, Ohio. He may be reached by addressing his mail to 18230 Lorain Avenue, Cleveland, Ohio.

Moore, Dolores F., H.E. L., of the Dietary Department, Meharry Medical College, Nashville, Tennessee, took a "Refresher Course for Dietitians" at Columbus University, New York City, this summer. Miss Moore will return to the Hubbard Hospital of the college in the fall.

Simek, Ervin J., F.P.E. A., writes that he has resigned from the Internal Security Branch of the Army Air Forces and is now working with North American Aviation, Incorporated, of Kansas. He is at present Director of Fire Protection and Prevention in the Kansas City Bomber Plant and the Kansas City Modification center. He resides at Wrennmoor Apts., 919 East Armour Boulevard, Kansas City, Missouri.

1939

Etter, Margaret E., H.E. L., writes that she is teaching Cafeteria Management and a Foods Class at the Thornton Township High School in Calumet City, Illinois. The enrollment the first year she was there was 1200 (1941), but last year it dropped to 1000. She enjoys her work very much. She has been teaching there since October, 1941. Her residence address is 304 West Warren Street, Calumet City, Illinois.

Under the date of June 26th, Thomas Collier, C.E. A., wrote Richard F. Odenwaldt, M.E. A'24, the following letter from Rio de Janeiro, Brazil:

Your alumni letter just caught up with me today, and am happy to know they have selected you for such an important task. Am sure that you will see that the Fund is filled to the brimming. How are all the boys at Jos. T. Ryerson?

Best of luck to you, Dick. Wish I could spare more—perhaps later.

My address is: (will appreciate any and all alumni publication):

(Signed) M/Sgt. Thos. Collier, 6881302
APO 676, Unit No. 1
c/o Postmaster
Miami, Florida.

Captain Percy W. Cump, Jr., C.E. A., whose address is Rotation Det., APO No. 703, c/o Postmaster, San Francisco, California, in a letter to Richard Odenwaldt, M.E. A'24, wrote:

"Dear Odenwaldt:

Received your April 26th V-mail a short time ago. It had followed me over half of New Guinea. Now after four years overseas—all in the tropics—I'm on my way home for that long awaited 21-day leave. At present, I'm in no position to send you anything, but should find the facilities when I get home.

Would please change my mailing address to 6656 Minerva Avenue, Chicago 37, Illinois.

Give my best to Prof. Hendricks when you see him.

Yours,
(Signed) Cump.'

Huboi, Carl F., Arch. A., is in the Seabees, now overseas. His home mailing address is Route No. 1, Elmhurst, Illinois.

Professor Joseph B. Finnegan was the recipient of this very interesting letter from somewhere in New Guinea:

"Dear Professor Finnegan:

Hearty greetings and good wishes to you, your staff and the Alumni Association. At this writing things in the S.W. Pacific are "looking up," not only from the standpoint of recent successes but also from prospects of leave and reassignment for us who have completed 1½ years overseas.

My time in the service has not dulled the memory of fraternal gatherings we used to have, and outstanding Alumni Banquets that were held each year. An invitation to the latest one just reached me a short while ago, but I was compelled to state, (two months late), that I would be unable to attend. However, I am looking forward to future invitations, and hope that I may be present at the next one or the one following.

I have recently given a bit of thought to additional study at the Institute after the war, and would like to inquire as to what onportunities exist for earning the degree of Master of Science. I have done my best to keep abreast of developments in the profession while I have been overseas, and although I realize an obligation to return to the Actuarial work I was in, time will probably be allowed me in order to continue study in the field of fire protection. Such post-graduate work will no doubt require daytime attendance at the Institute. If night work will be permitted, information pertaining thereto will be appreciated. If you can furnish the data regarding this work, please inform me of the necessary fees required.

Congratulations to you and the hard-working faculty at Tech. The results of the tremendous amount of work you are doing will be shown in bringing the time nearer when we can all return home to resume the work we had to leave so quickly. The volume of equipment sent to us in the past year would never have reached the front without the engineering progress made possible by Illinois Tech and the other Engineering Institutions in the United States. Thumbs up!

Very cordially yours,
(Signed) Lt. (j.g.) D. W. Jacobson, F.P.E. A.
USNR U.S.S. Henry T. Allen
c/o Fleet Post Office
San Francisco, California.

Lindahl, John C., Arch. A., works as an architect for the Pan-American Airways, Alaska Division, Boeing Field, Seattle, Washington. His residence address is 6931 30th Place, South, Apt. 338, Seattle, Washington.

Lieutenant Fred W. Neubauer, C.E. A., is with the 2nd Weather Recon. Squd., Key Field, Mississippi.

Captain Morris Skurka, E.E. L., of the 28th Air Depot Headquarters, Sqdn., APO No. 492, c:o Postmaster, New York City, New York, writes from India:

"Hello:

Just a few lines to let you atl know where I am. I am here in India trying to get this whole thing over with.

The Technometer has been following me all over, and I am very happy to receive it. I am very much interested in the future of I.I.T.

Keep up your good work.

Sincerely,
(Signed) Morris Skurka."

1940

Lieutenant Donald M. Graham's, C.E. L., mailing address is 1919th Engr. Avn. Co., APO No. 708, c/o Postmaster, San Francisco, California.

A very interesting letter was received from Lt. Edward T. Miniejka, M.E. A., and reads as follows:

"I am very interested in keeping up with the latest progress and developments taking place in the Alumni Association and am anxious to receive all the printed material available.

Due to several changes in duty your mail has been delayed in reaching me. In order to avoid any further delay I would like to submit my new official address:

Lt. (j.g.) E. T. Miniejka, U.S.N.R.
U.S.S. Astoria
c/o Fleet Post Office
New York City, New York.

Since I entered the Naval Service two years ago I have traveled extensively all over the country, and have had the good fortune of having a variety of duty. At the present time I am a gunnery officer on the USS Astoria. I had the honor of putting her in commission and am officially a "plank-owner" of the USS Astoria.

Wish I could write more but time is something I don't have too much of.

Until later with my sincerest wishes for success in all your endeavors, I remain,

Sincerely yours,
(Signed) Edward T. Miniejka."

Thorsen, Mrs. Henry A., (Dorothy M. McArdle), A.S. L., writes that her husband, Lt. Henry A. Thorsen, A.S. L., is now stationed at Camp Blanding, Florida. They are temporarily living at 224 Temple Street, Starke, Florida.

1941

Ensign Otto E. Bartelides, C.E. I., of the United States Navy, writes his new mailing address is 23 NCB, FPO, San Francisco, California.

Bauer, Norman T., I e., writes: "The Alumni publications are a very welcome sight when mail call comes around. Please change my address to PFC Norman T. Bauer, 16100246, Btry. C., 69th AAA Gun Bn., Camp Haan, California, so I won't miss any of them."

John W. Brierley's, C.E. I., new mailing address is 154 Franklin Street, Bloomfield, New Jersey.

Hill, Charles F., M.E. I., a Lieutenant (j.g.) in the United States Naval Reserve new address is: c/o USS "Wisconsin," c/o Fleet Post Office, New York City, New York.

Kuliexe, Jr., Frederick C., M.E. I., requests that his mail be sent to Ensign Frederick C. Kulieke, Jr., U.S.N.R., 511 South Lincoln Avenue, Alliance, Ohio.

Pvt. Louis Maze, E.E. I., Det. C, Proving Grd. Det., Bks. 358, Aberdeen Proving Ground, Maryland, wrote:

"Dear Mr. Schommer:

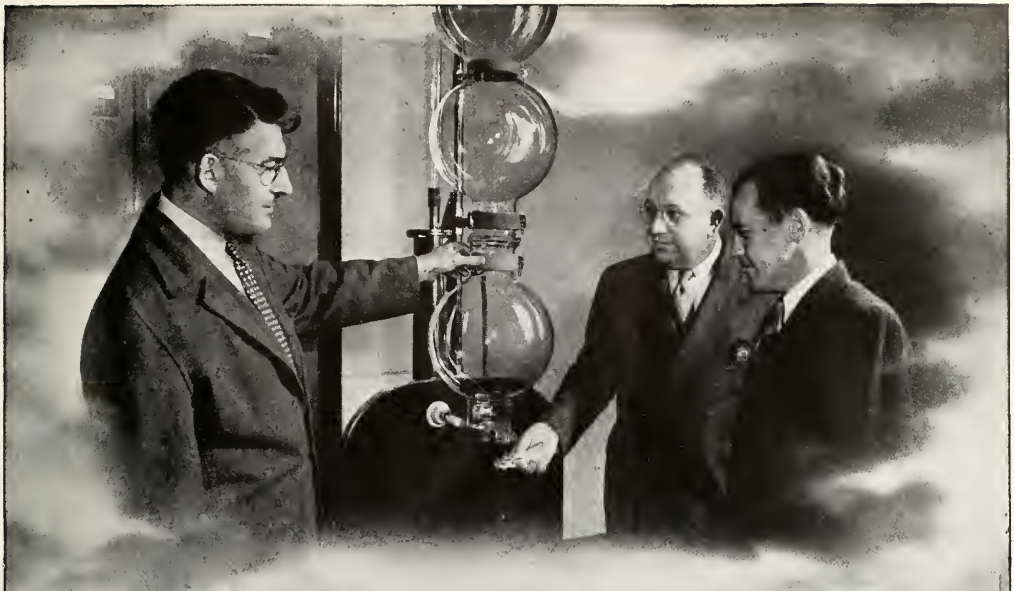
I was very glad to get your most welcome letter. I am still on this side of the ocean so the V-mail arrived in its original.

The note was very heartening. It sure cheered me up and the fellows I showed it to also got an uplift from it.

Here's hoping you find time for more such cheering notes.

(Signed) Louis Maze."

Staff Sergeant Howard E. Meyer, F.P.E. I., 819th Signal Port Serv. Co., APO No. 653, New



New RCA Penicillin Process Speeds Production!

TODAY, when the wonder-drug penicillin is so vitally needed on the fighting fronts and in the home-front sickrooms, the Radio Corporation of America reveals that a revolutionary method of production has been perfected in RCA Laboratories.

Tests at the Squibb Penicillin production center at New Brunswick, N. J., show that a single RCA electronic installation can concentrate two billion Oxford units of Penicillin in 24 hours—enough to administer 100,000 individual doses.

Besides streamlining the elaborate evaporation method, the new RCA Electronic system includes these important advantages: reduction of operation costs, lowered maintenance costs, less possibility of mechanical difficulties and production delays, great savings in floor space, and impressive reduction in initial equipment costs.

The new RCA electronic dehydrator of penicillin is shown here in regular operation at the plant of E. R. Squibb & Sons.

RADIO CORPORATION OF AMERICA
RCA LABORATORIES • PRINCETON • NEW JERSEY

RCA
leads the way in
radio—television—
phonographs—records
—tubes—electronics

RCA

Listen to RCA's "The Music America Loves Best"—Sunday, 4:30 P.M., E.W.T., over the NBC Network ★ BUY WAR BONDS EVERY PAY DAY ★

York City, New York, is now stationed in England. In a recent letter from Mr. H. M. Neben, giving us her husband's address, she also wrote:

"I am forwarding your V-mail letter dated June, 1944, to my husband overseas. I know he'll enjoy reading it.

I am enclosing his present address, thinking that you might like to send letters directly to him. The address is as follows:

T/Sgt. Harry M. Neren, (E.E. I)
ASN 16071432
OSS Detachment
APO No. 887, c/o Postmaster
New York City, New York.

May I take the liberty of complimenting the writer of the V-mail letter, which is most interesting and very clever. I'm sure I.I.T. boys far from home will enjoy reading it.

Yours very truly,
(Signed) Helen Neren (Mrs. H. M.)

1942

1st Lieutenant Ken M. Grasse, Ch.E. I., is a meteorologist with the 15th Air Force, "somewhere in Italy." He flew there in a B-24 Liberator Bomber. Lieutenant Grasse's home address is 8940 Laflin Street, Chicago, Illinois.

Hammond, Hirstle M., E.E. I., writes that he is employed as an electronic field service engineer by Sperry Gyroscope Company, Brooklyn, New York, and has been attached to a Marine Night Fighter Squadron for the past several months. He finds the work exceedingly interesting, absorbing, and at times even exciting. Living with the Marine pilots has been a pleasant experience and he finds them to be a swell bunch of fellows. He has worked some with the Army at Wright Field, and quite a bit with the Navy. In the course of his work he has collected a few Jap souvenirs (the most prized one being a gyro-compass) and has been present at several enemy night bombing raids and thrilled when three Jap medium bombers were shot down one night. The equipment he has been working with is quite complex and at times has taxed his ingenuity, particularly when forced to operate with only a pocket screw-driver. Many of the tricks learned in electronic and dynamo laboratories and all of the "common sense" gained at Illinois Tech have been needed for this job. Hammond met Curtis Hepperle, E.E. I.'43 when he was visiting the Sperry Gyroscope Company Research Laboratories at Garden City, New York. Has also seen several E.E. I., men at Naval research Laboratories. He requests that his mail be sent to Hirstle M. Hammond, Dept. 1872, Sperry Gyroscope Company, Brooklyn, New York.

According to a recent news release from the Oklahoma City Air Service Command, Tinker Army Air Field, Oklahoma City, Oklahoma, 2nd Lieutenant Howard Jarmy, M.E. I., is Assistant Maintenance Officer. Prior to entering the service, Lieutenant Jarmy was employed as Assistant Aircraft Maintenance Supervisor at Patterson Field, Fairfield, Ohio.

Lilek, Ernest F., A.S. I., writes that he has been receiving the Technometer for the past two years and has enjoyed it very much. It followed him around since April 1943, at which time he departed Unalga Island in the Aleutians. He has served eighteen months in the Aleutians at various stations, the last being the we'l known island of Attu that was retaken from the Japanese May 1943. The stay up north was a pleasant one even with all its shortages. He is now an aerologist, that is, since he has been in the Navy and he finds the work quite interesting. Many is the time a good "sweat" was the result of a days work but somehow he survived and still finds himself alive, well, and kicking. He will keep his eye peeled for future copies of the Technometer. His military address is: Lt. Ernest F. Lilek, Aerology COMFAIRWING SIX, c/o Fleet Post Office, San Francisco, California.

Spitz, Warren E., Arch. I., reports his new mailing address:

Lt. (jg) Warren E. Spitz, C-V (S) USNR
Comphibtrapac (Admin)
Fleet Post Office
San Diego, California.

Mrs. Charles Sterba, Jr., was notified on July 18, 1944 that her husband, Lt. Charles F. Sterba, Jr., M.E. I., was wounded in action June 25 according to a news release from the Chicago Daily Times. Lt. Sterba was commissioned on July 3, 1943, and had been overseas 10 months at the time. He has a 14-month-old son.

Swanson, Carl A., M.E. I., writes that he is now in the United States Navy. He is a Seaman First Class in the Radio Technician Group.

1943

Anderson, Roy A., Ch.E. I., writes that after being in the Navy for three months, he is finally settled in one place for a little while. He was at Great Lakes, Illinois for five weeks and was then transferred to San Diego, California to attend Hospital School. While in San Diego, California he met another alumnus, Milt Burkhart I. '44 and both are feeling fine. His milltary address is R. A. Anderson, S2/c, U.S.N. Hospital Corp School, Co. 4-1, San Diego 34, California.

Mr. A. Grotto wrote the Alumni Office and requested that the former classmates of LeRoy A. Grotto, A.S. I., write to him. He may be reached by addressing his mail to Pvt. LeRoy Grotto, A.S.N. 36786506, 813th Chemical Company, Grand Central Air Terminal, Glendale, California.

Lukes, Robert F., F.P.E. I., is now on submarine patrol duty in the Pacific Ocean. His residence address is 7820 South Park Avenue, Chicago, Illinois.

Meagher, Richard F., E.E. I., a Private in the United States Medical Corps is stationed at the Station Hospital, Medical Detachment, Camp Sibert, Alabama.

Henry O. Miller's, M.E. I., residence address is 2235 South 60th Court, Cicero 50, Illinois.

Lieutenant George F. Petterson, Arch. I., 0-711470, 567th Sqd., 389th Bomb. Gp. (H), APO No. 558, c/o Postmaster, New York City, New York, is stationed "Somewhere in England."

Seemann, Herman A., Ch.E. I., who is employed as Safety Engineer by The Linde Air Products Company of New York, resides at 898 Kensington Avenue, Buffalo, New York.

Trapp, Robert M., Ch.E. I., is employed as a Chemical Engineer by Phillips Petroleum Company, P. O. Box 391, Berger, Texas.

Ensign Emil E. Sobilo, O-V (S) U.S.N.R., M.E. I., is with Ordnance Production, Navy Yards, Boston, Massachusetts.

1944

Anderson, Harlan J., M.E. I., works for the National Advisory Committee for Aeronautics, Aircraft Engine Research Laboratory, Cleveland Airport, Cleveland, Ohio as a Mechanical Engineer. He resides at 1287 Giel Avenue, Lakewood 7, Ohio.

Private Kenneth L. Bick, M.E. I., is in the Ground Forces of the United States Army. His military address is C-10 A.R.T.C., Fort Knox, Kentucky.

Private Leonard V. Czerwonko, Ch.E. I., writes he has been receiving the Technometer and Engineer and Alumnus and is interested in all the news. He may be reached by addressing his mail to 2009th Ord. M. Co. A.F., APO No. 149, c/o Postmaster, New York City, New York.

Epstein, Kenneth J., M.E. I., a graduate of ASTP in Mechanical Engineering and then assigned to Infantry as PFC. is now with Co. I, 303rd Infantry, APO 445, Fort Wood, Missouri.

Haskett, Lester E., E.E. I., has recently changed his military address to Pvt. Lester E. Haskett, A.S.F.T.C., Camp Crowder, Missouri.

Ensign Blake H. Hooper, Ch.E. I., U.S.N.R., U.S.S. R-20, c/o Fleet Post Office, New York City, New York, in a recent letter to the Alumni Office writes "Just getting established on a new boat. Regards to John Schommer, Sonny and all the gang."

Koci, Raymond J., M.E. I., is an Apprentice Seaman and is stationed at Company 654-44, Camp Hill U.S.N.T.C., Farragut, Idaho.

Kunz, William J., M.E. I., is in the United States Navy. He may be reached at his residence address 3308 North Ozanam Avenue, Chicago, Illinois.

Long, Roger K., C.E. I., enlisted in the U. S. Army August 8, 1942. Mail will reach him by addressing him at Co. F, 328th Infantry, Fort Jackson, South Carolina.

Schulze, George H., E.E. I., is employed as Junior Engineer with the Westinghouse Electric & Manufacturing Company, 150 Pacific Avenue, Jersey City, New Jersey. He resides at 654 S. Bergen Avenue, Jersey City.

Serazin, Frank, E.E. I., who started his Navy career at Illinois Institute of Technology has been transferred to the Asbury Park Pre-Midshipman's School. His address is now, Frank Serazin, A.S. V-12, U.S.N.R.P.M.S., Section 806, Asbury Park, New Jersey.

Yessne, Harmon S., M.E. I., is employed by the Aeronautical Engine Research Laboratory of the N.A.C.A. in Cleveland, Ohio. He resides at 1234 Michigan Avenue, Lakewood 7, Ohio.

Young, Sheldon E., C.E. I., has been awarded a $25.00 prize from the James F. Lincoln Arc Welding Foundation of Cleveland, Ohio for his paper on "The Advantages of Welding Over Riveted Design." Mr. Young resides at 7553 Cregier Avenue, Chicago, Illinois.

1945

A V-mail letter was received from Sergeant Thomas F. Belcik, M.E. I., which reads as follows:

"Your letter of April 26th has at long last reached me. The news about Post-war refresher courses etc. was very interesting. I've been trying to make plans for returning to I.I.T. after the war, but I didn't want to completely start from scratch again. I'd appreciate hearing more about I.I.T.'s post-war plans. Am looking forward to John Schommer giving a good account of himself in forming these plans.

The Technometer and Engineer are not up to date on my address. Kindly send them to my latest location. Thank you.

(Signed) Sgt. Thomas F. Belcik—16138532
423rd Bomb Sqdrn. 306th Bomb Grp.
A.P.O. No. 557 c/o Postmaster
New York City, New York."

A V-mail letter informs us that Corporal Seymour Padove, M.E. I., is sweating it out in Ceylon. He writes that this place really makes you appreciate the states (or as we call it here —"Shangrala") more and more. His military address is 3115th Signal Service Battalion, A.P.O. No. 432, c/o Postmaster, New York City, New York.

Mrs. M. Pisz writes that her son Ted S. Pisz, M.E. I., is in the United States Army. She requests that his mail be sent to Pvt. Ted S. Pisz, 36741961, Co. "B", 510 M.P. Bn. (A), A.P.O. No. 5262, c/o Postmaster, New York City, New York.

Snodgrass, James H., M.E. I., is in the United States Army. He is a Private First Class.

1946

Seidell, Richard, E.E. I., a Private First Class in the United States Army may be reached by addressing his mail to Co. H, 232nd Infantry, A.P.O. No. 411, Camp Gruber, Oklahoma.

BIRTHS

1936

On March 1, 1944, a son, Roger, was born to Mr. and Mrs. Leonard Karvel (Lucille V. DeLuca), H.E. L.

1937

Mr. and Mrs. Thomas G. Busack (Dorothy R. Schlagel), A.S. I., & A.S. I.'38, announced the birth of a daughter, Kathie born April 1944. They also have a son, Peter Thomas.

1941

On January 5, 1944, a daughter, Barbara Alene, was born to Mr. and Mrs. Alexander T. Reynolds, M.E. I. Mrs. Reynolds is the former Lillian A. Snodgrass, A.S. I.

Mr. and Mrs. Paul E. Flaskamp, A.S. I., announce the birth of a son, Paul Rand in July 1944.

Reimer, Gerhard M., M.E. I., announces the birth of a daughter, Myrtle Karan on August 13, 1944.

ENGAGEMENTS

1942

Mr. and Mrs. Joseph H. Lazar announce the betrothal of their daughter, Elaine June, to Daniel M. Brown, M.E. I., the son of Mr. and Mrs. Max Brown. Miss Lazar attended the University of Wisconsin and is now studying at Northwestern University.

Saperstein, Seymour, M.E. I., a First Lieutenant in the United States Army Air Forces—Air Transport Command in Labrador, announces his engagement to Miss Etta Fine, daughter of Mr. and Mrs. David Fine, 631 West Waveland Avenue, Chicago, Illinois. Miss Fine is a graduate of Northwestern University.

1944

Prof. and Mrs. Edwin C. Robbins of Cambridge, Massachusetts, announce the engagement of their daughter, Miss Dorothy Evelyn Robbins to Pvt. Richard D. McKinsey, Arch. I., son of Mrs. James O. McKinsey of Chicago and Lake Forest, Illinois, and the late Mr. McKinsey.

Pvt. McKinsey is stationed at Fort Devens.

MARRIAGES

1942

On January 19, 1944, Lt. Otto J. Kralovec, A.S. I., married the former Miss Grace Pruitt. Mrs. Kralovec is employed by the Institute of Technology as secretary to President Heald, the position she maintained before her marriage.

1934

Smith, Mrs. Slava Sara, A.S. I., announces her marriage to Sgt. Joseph Rusinko, United States Army Air Force on April 12, 1944. The ceremony took place in the Memorial Chapel at Fort Snelling, Minnesota. She is now at home at 617 Twenty-fourth Avenue, N.E., Minneapolis, Minnesota.

1939

Mr. and Mrs. Ernest F. Shelton announce the marriage of their daughter Mary Alice Shelton, Ensign, United States Naval Reserve to Winchester G. Felt, E.E. A., Lieutenant, in the United States Army, Sunday the thirtieth of April, 1944. The ceremony took place at Fresno, California.

A METAL FOR TODAY AND TOMORROW . . .
MAGNESIUM'S USEFULNESS IS BROAD YET CLEARLY DEFINED

Magnesium is aptly called *the Metal of Motion*. For this abundant basic metal, extracted by Dow from sea water and from Michigan brine, is the lightest of all structural metals, it is durable and strong, and so it finds its place wherever metal is to be put in motion, wherever inertia is to be overcome. In all the varied fields of transportation—on highway, rail, or in the air—magnesium will help move people and materials faster, over greater ranges, more economically. In the moving and reciprocating parts of machines . . . in hand- and power-operated tools, equipment and home appliances . . . in these places is magnesium's inherent usefulness so naturally and peculiarly valuable. It is only logical, therefore, that the weight-saving characteristics of magnesium should inspire new ideas. The Metal of Motion is leading designers directly to fresh concepts of efficiency and speed and comfort for everyday life in our time.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

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1940

Dr. and Mrs. Walter B. Schindler announce the marriage of their daughter Jayne Marie to Lt. George P. Hanna, C.E., A., on June 22, 1944. The ceremony took place at the Hendricks Chapel, Syracuse, New York.

1941

Demoney, Fred W., F.F.E. I., was married to Miss Ione Christine Edstrom on the third of June, 1944. The event took place at eight o'clock in the evening at the Spring Garden Lutheran Church in Cannon Falls, Minnesota.

1943

Mr. and Mrs. Paul S. Hughes announce the marriage of their daughter, Marion Dowell Childrey to Carl L. Stroitman, M.E. I., on May 15th, 1944 at Grace Episcopal Church, Merchantville, New Jersey.

1944

Another bride whose wedding was hastened because of the exigencies of the service was that of Miss Claire Gertrude Devlin, daughter of Mr. and Mrs. H. J. Devlin of Glen Avenue, Edgewood, Rhode Island, to Ensign Girard Lee Bovie, C.E. I., of the United States Naval Reserve, son of Mr. and Mrs. George Bovie of Chicago, Illinois. The ceremony took place in St. Paul's Church, Edgewood, with Rev. Patrick S. Canning officiating.

The bride given in marriage by her father, wore an eggshell gown, designed with a bodice of lace and a skirt of satin. Her finger-tip veil was arranged in a cluster or orange blossoms and she carried a Colonial bouquet of white roses with a cascade of white satin streamers.

Miss Dorothy M. Taipe, was maid of honor. Her gown was styled with an ice blue bodice and a floral skirt. On her head she wore a blue rosette crown and her colonial bouquet combined pink roses, interspersed with blue delphinium.

Ens. Timothy J. O'Leary, USNR, of Chicago, was best man. A program of wedding music was furnished by Mr. James I. Wray, "O Promise Me" and "Ave Maria" were sung by the soloist.

At the reception at the Narragansett Hotel, which followed the ceremony, Mrs. Devlin, mother of the bride, wore a gown of aqua net and a corsage of two-tone talisman roses. Mrs. Bovie is a graduate of Bryant College. This newspaper clipping was received from the Providence, Rhode Island Journal of August 28, 1944.

Kidd, Robert C., M.E. I., of the United States Naval Reserve, was married to Patricia Burnielle Lamb on Saturday the first of July, 1944. The ceremony was performed at three-thirty in the afternoon at the Calvary Methodist Church. Chicago, Illinois.

KILLED IN ACTION

1938

Chayes, Bernard, Ch.E. A., a Lieutenant in the United States Army Air Forces, was killed while on duty somewhere in China.

1939

Spengler, John A., Ch.E. A., a Lieutenant in the United States Naval Reserve and engineering officer of an LST (landing ship, tank), was killed in action in the European theater July 8, 1944. Before enlisting three years ago he was employed by the American Fore Insurance Company. He is survived by his parents and a brother Chester Spengler.

1943

Lt. Robert F. Wilson, A.S. I., gave his life for his country a year ago in August 1943.

1941

Reinhardt, Charles H., Jr., A.S. I., a Lieutenant in the United States Army was killed in action somewhere in Normandy on June 29, 1944. Lt. Reinhardt, Jr., is survived by his wife, Mrs. Charles H. Reinhardt, Jr. (Lorraine Hamm), I'40, and a son Charles, and his mother.

OBITUARIES

1900

Mason, George, Jr., Ac. L., of 603 Addison Street, retired vice president of the Scully Steel Products Company, now the U. S. Steel Supply company, passed away in the Alexian Brothers Hospital a few months ago. He had been connected with the company 43 years at the time of his retirement three years ago. He is survived by his widow, Mrs. Helen Russell Mason, and by two sisters, Mrs. Perrin Richardson and Mrs. Emma M. Carroll.

1903

Rawson, H. Boyd, E.E. A., passed away at Hines Veterans Hospital on July 24, 1944. He had been in the hospital since March on account of arthritis. After graduation Mr. Rawson for a number of years was engaged in the construction of cement plants. Later he lived on a ranch at Shelby, Montana. Besides his wife who was with him when he died, he leaves three daughters. He was a veteran of the Spanish-American War.

1904

Savage, Howard P., Ac. L., for 12 years business manager of the Chicago Board of Education and former national and state commander of the American Legion, which he helped organize, died May 8, 1944. Savage served overseas as an officer with the 55th engineers in World War I. After the war he organized the Chicago Elevated Post 184, devoted much of his time to raising money for endowment of the Legion, and later was elected commander for Illinois. In 1913 Savage started work as a track foreman for the Metropolitan West Side Elevated Railroad, now a part of the Rapid Transit System. He later became general superintendent of maintenance of way for the elevated lines and assistant general manager of the school board in 1932, and in 1933 served as president of the north shore park board, which was lated included in the consolidation of parks into the Chicago Park District.

1907

Kealy, Col. Philip J., A.S. L., chairman of the Chicago traction board of supervising engineers, died in August 1944 at his home, 37 Indian Hill Road, Winnetka, Illinois. He was 60 years old. A native of Bloomington, Illinois, Col. Kealy attended Lewis Institute, Chicago, and the University of Illinois. In 1915, at the age of 31, he became president of the Kansas City railways. He commanded the 3rd Missouri Infantry in the first World War. Col. Healy was a member of the American Society of Civil Engineers and the Chicago Athletic Association. He is survived by his widow, Mrs. Joyce H. Kealy; a daughter, Mrs. James A. Cowley of Miami, Florida; three sons, Sgt. J. Gerald, who is with the army in Italy, Hutchins D., and Hinman L.

1923

Cooley, Mortimer E., H.D. A., Professor and Dean at the University of Michigan, Ann Arbor, Michigan died on August 25, 1944. Colley had been a Professor at the University since 1881 and Dean of Colleges of Engineering and Architecture since 1904. He resided at 1405 Hill Street, Ann Arbor, Michigan.

1927

Friends of Herman W. Lusche, M.E. A., were grieved to hear of his death on April 20, 1944 following a sudden heart attack suffered the previous evening. Herman had been associated with Aero Division, the Airport, and Methods department in both Main and Lake street plants, Minneapolis, Minnesota, and his winning smile and warm personality had won him scores of friends.

The Alumni office has been advised of the death of the following Alumni:

Mrs. C. C. Fogarty (Bess Griswold), Ac. L'01.
Alfred H. Fischer, Ac. L'02.
Clara Beatrice Jophes A.A. L'05.
Edwin F. Gillette, A. A'06.
Albert L. Dieckman, M.E. L'08.
Walter H. Hallsteen, C.E. A'14.
Mrs. William D. Rolph (Harriet B. Chapman), Ac L'16.
Mrs. C. M. Wood (Florence Swan), H.E. L'14.
Bernard R. Zeman, A.S. L'20.
Olive Thompson, A.S. L'22.
Henry F. Andree, A.S. L'25.
Adelbert L. Anderson, A.S. L'26.
McNaul, DeEtte Armina, A.S. L'38.

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The perfection of a hundred years of American brewing skill sparkles in every delicious drop of Pabst Blue Ribbon Beer . . . the symbol of friendly companionship . . . yours to enjoy.

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blended into One Great Beer

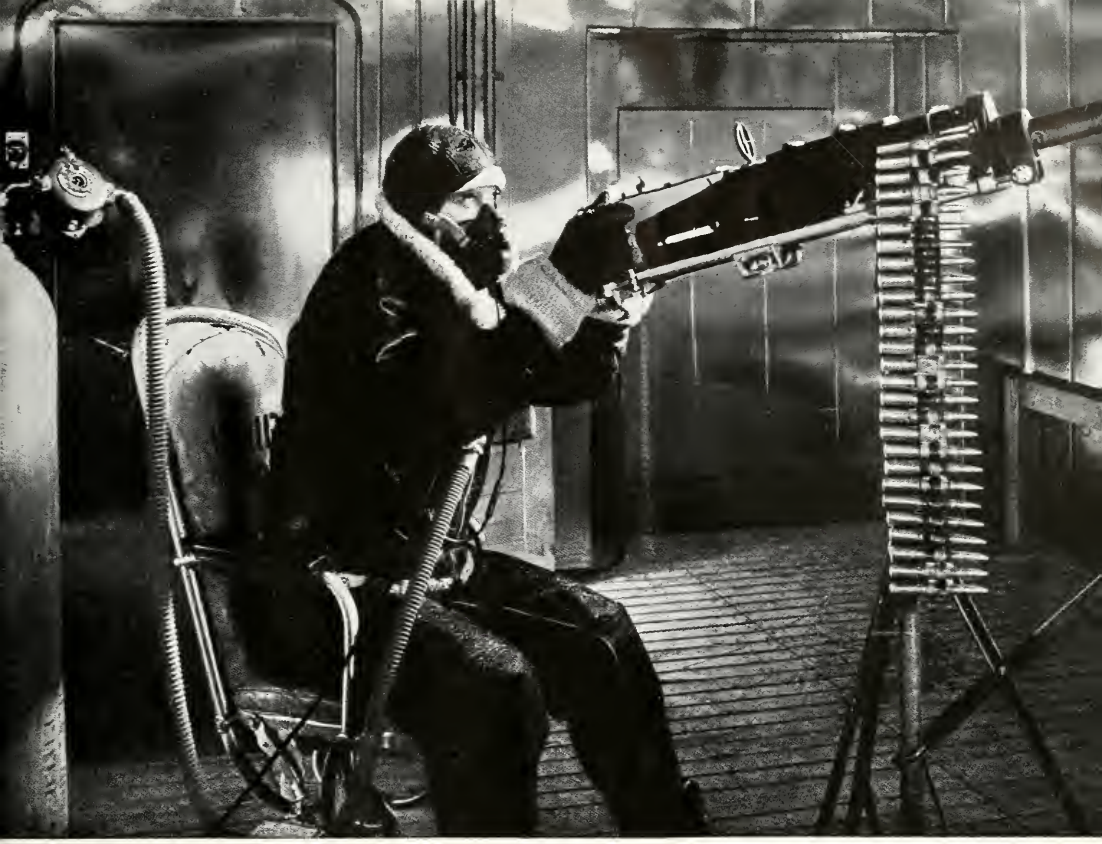
(Continued from Page 18)

itself into a debate as to the advisability of completing a protective program or going along as before. Management is credited with intelligence and when it is brought to their attention that certain hazards exist, the willingness to comply with reasonable recommendations is a matter of securing needed materials and manpower to do the work.

Fire protection recommendations run the scale from those that are expensive and difficult to complete to those that may have attention with a simple re-arrangement with no expense involved. It has been stated on occasion that recommendations are arbitrarily offered, that the only intention is to see that some change is made, and that the engineer must do something to warrant his position. Professional engineers, and fire protection engineers are so classified, have as a duty, to offer only those recommendations that will eliminate or protect a known hazard or condition at a minimum of expense. Many times the nature of the work done by the fire protection engineer is not clearly understood by the property owner, thus when other interests offer unreasonable recommendations the thought is that they emanate through the business connection of the engineer. When granting permission for an inspection of their properties management should determine the purpose for which it is made. Also, they should review very closely the recommendations that may be offered, and if necessary, call upon a disinterested fire protection engineer to advise regarding the merits of the particular recommendations that are having consideration.

Under war conditions installation of some protective equipment was hasty and made only with the intention of serving effectively for the duration of the conflict. It may be expected that there will be failures in this type of installation, especially those involving electrical equipment where exposed to humid and corrosive atmospheres. In completing fire protection surveys at the conclusion of the conflict attention must be paid to the condition of such installations and recommendations undoubtedly will call for a replacement of many emergency facilities. Further, in plants where entire processes have been discontinued for the period of the conflict and where it is intended that these again be put into operation by using former equipment extensive testing will be required to determine whether they may be re-

(Continued on Page 46)



Storms that SAVE Lives

STORMS OF HAIL AND OF SAND . . . storms of rain and sleet, and fog. Temperatures of 60 degrees below zero Fahrenheit and 150 degrees above. Such combat conditions and low pressures of high altitudes can be produced in the weather chamber which you see here being used for testing Army Air Force equipment—equipment upon which the fighting effectiveness and the lives of men depend.

Stainless steel—large-scale production of which was made possible by the development of low-carbon ferrochromium by ELECTRO METALLURGICAL COMPANY, a Unit of UCC—lines the interior of the weather chamber. *For stainless steel* has the necessary resistance to the tortures that beset this all-weather "test-tube" room for research in materiel.

Tough, durable, rustproof, stainless steels are also used in surgical instruments, operating tables, and other hospital equipment. And, because they are easy to keep clean and resist food acids, they are widely used in equipment necessary to the preparation, processing, and serving of foods. "After-the-war abundance" will make it possible for all of us in thousands of places in industry and the home to enjoy the luxury as well as the utility of stainless steels.

Units of UCC do not make steel of any kind, but they do make available to steelmakers many alloys which give new properties to and improve the quality of steel. The basic research of these Units means new, useful metallurgical information—and better metals for the needs of men.

▼ ▼

Executives, architects, designers, teachers, and other professional men are invited to send for the booklet P-10 "Stainless Steels and their Uses." There is no obligation.

BUY UNITED STATES WAR BONDS AND STAMPS

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garded as safe from an operating and protection standpoint.

War-time construction has necessarily been of a type that would permit rapid completion with whatever materials may have been available at the time. Many plants that were regarded as being well protected from outside exposures now find themselves surrounded by extensive additions of inferior construction. Whether it will be possible to remove these structures will depend upon how well integrated the former process of a given plant is to the war expansion program. The particular construction of the addition and the possibility of providing effective protective equipment, such as automatic sprinklers, will be tempered by the simple solution of removing the offending structures.

Post-war developments in industry, especially those involving chemical and electrical processes, will require close study by the profession to determine the hazards that may be present and to indicate the protective steps required to minimize or eliminate such hazards. Many operators develop a protective study along with a process development and indicate what special steps may be needed in the operation of their equipment, while others depend upon field experience to develop such data and permit the protective problem to rest in the hands of the user of the equipment. Thus it may be that a long period of time will pass in the use of certain equipment before adequate protective programs can be indicated for safe use of such equipment.

The fire protection engineering field, unlike other fields of engineering, where the individnal may confine his activities in a rather narrow sphere, requires a broad knowledge of the protection problems involved in the occupancy and process of features in all classes of operations whether industrial, manufacturing, utility or public property. This requires a firm foundation in the fundamentals of engineering after which wide field experience must be acquired before the engineer evolves.

So far as the home owner is concerned, the problem concerns largely the kind of house that is delivered to him by the contractor. The reputable contractor would be opposed to any circumvention of building codes or safe standards in the interest of providing a safe home for his client. After taking occupancy, the home owner in making changes may follow the easiest path and introduce features that may be known to be hazardous. Changes in construction or electrical features should be done by craftsmen

(Continued on Page 56)

Sand in Adolf's eye...

THIS man is a glass chemist. And the sand he's working with is going to get into Adolf Hitler's eyes and hurt.

Here's how. Glass, basically is made from sand. And glass in this war, in the skilled hands of American glass makers, is a potent weapon. It replaces metals on many jobs, metals needed for killing Huns and Japs.

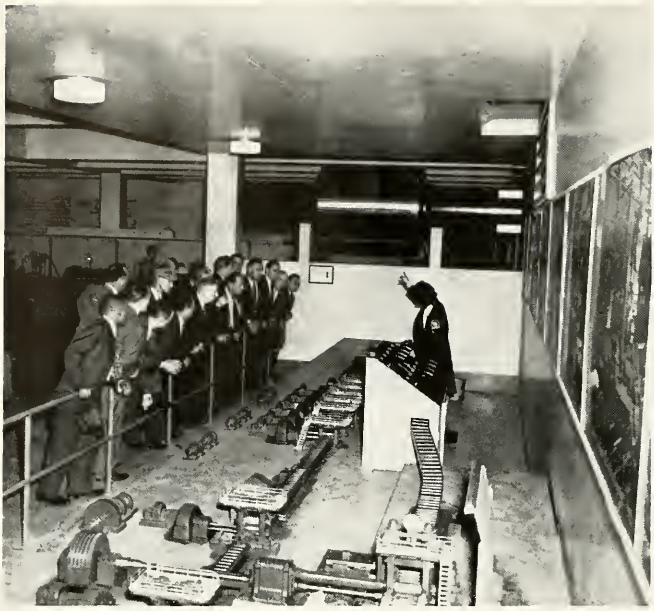
In bombsights and fire control instruments glass helps to rain accurate death on the enemy. In heavy industries, such as the explosive industry, its characteristic resistance to corrosion speeds powder output. Glass in medical and laboratory fields puts us and our allies ahead in hospital treatment and in vital laboratory developments.

The U.S. is lucky in having a well established glass industry and not having to lean upon any part of the outside world for this essential material. Glass was ready for war, and was able to contribute to the speed records set by other industries such as gasoline and synthetic rubber.

It took a lot of research to make American glass the best in the world. At Corning way back in peacetime, more than 200 laboratory men were working steadily on new forms of glass and new uses for this amazing material. More than 25,000 formulae for glass were developed. Today around 250 different types of glass are in production under the "E" pennant at Corning's main plant.

There are glasses for example that withstand corrosive chemicals, that cannot be harmed by heat, that have high electrical insulating qualities, that are extremely resistant to mechanical breakage. And these are only a few of the reasons that engineers, too, consider glass the material with endless possibilities for the future. Corning Glass Works, Corning, New York.

CORNING
means
Research in Glass



Milwaukee Foundry Foremen Observe Miniature Steel Rolling Mill in Operation

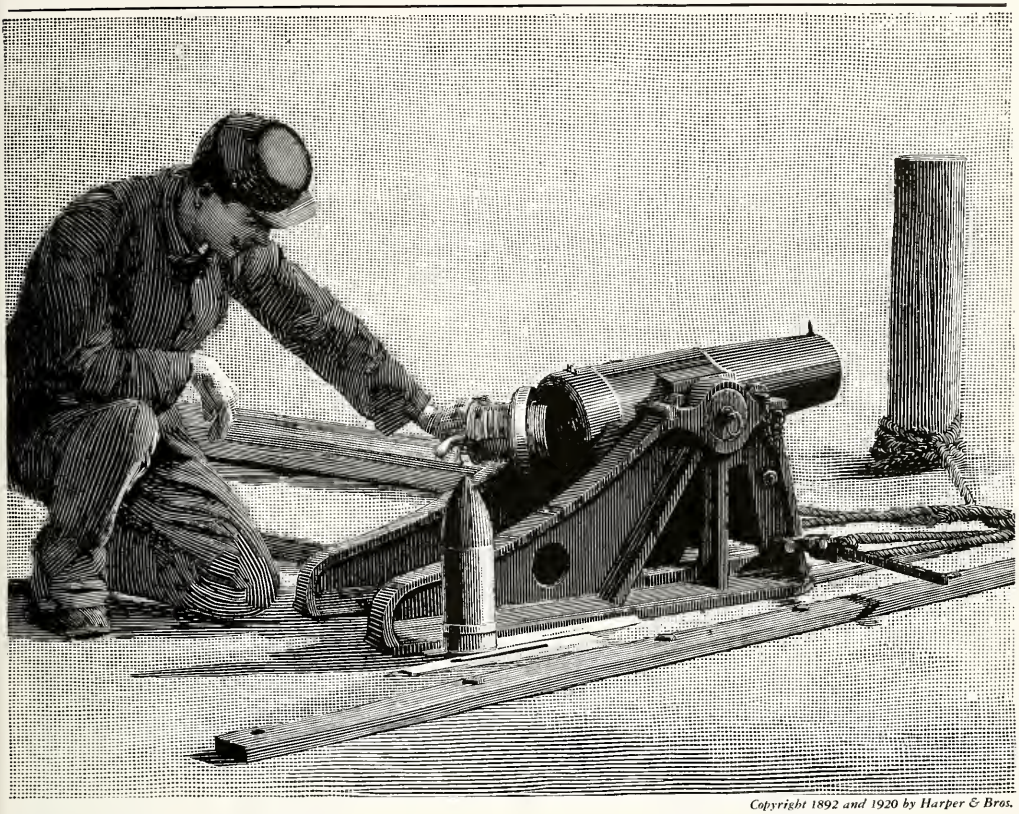
E. S. M. W. T.

(Continued from Page 24)

Engineering colleges and others should find some means of preserving the discoveries made during the war period that have contributed to effective teaching. Use of visual education, visits to industries, bringing in instructors who have both educational qualifications and large industrial experience is something which should be preserved in some form or other, especially for adults who wish to change their occupations in as short a time as possible.

College instructors have been so busy with civilian day-students and Army and Navy students that they could not participate in the Engineering, Science and Management War Training Program. It is unfortunate that they will not have benefited by the experience developed under this program. A committee of liberal engineering educators who participated in this program should evaluate the program before it is totally forgotten so that benefits derived under the stress and strain of war needs may be preserved for peacetime activities. Colleges could profitably offer an over-all intensive summer course which would enable individuals in ten to twelve weeks to make a more desirable occupational adjustment.

"This is a Grinding War . . ."



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MORTAR'S GRANDPA

You could pick up this U. S. mortar about as easily as you could move a safe and it was about as easy to move around. But its advocates back in the nineties foresaw the importance of such armament in modern warfare.

Today's version can be carried at a brisk trot by a couple of men. It can go into action in seconds. It's a precision weapon —precision built, facts that many a Nazi and Jap have discovered with a jolt.

Where did a lot of the modern mortar's precision come from? From a little iron-bowl furnace in which over 52 years ago, Dr. Edward Goodrich Acheson created the first man-made abrasive. Since then abrasive products have become one of our most important production tools in the skilled hands of American industry.

Abrasive wheels are used to grind the parts of mortars, plane and tank engines, giant guns and other war weapons to unbelievable accuracy.

This accuracy is responsible not only for the efficient performance of these weapons—it also makes their mass production possible.

For mass production depends on interchangeability of parts. And interchangeability depends on split-hair precision.

Today it is almost impossible to put your finger on a single article mass produced for war or for peace that isn't in some way touched by grinding. On the land, in the air, on and under the sea, material produced by abrasive manufacturing methods are blasting the path to victory for the United Nations.

We at Carborundum are mindful that "this is a grinding war." Our efforts and resources are pledged to making it as short as possible.

* * *

These are just a few of the reasons why engineers believe a working knowledge of abrasives is a pretty good thing to have. Write us today for a complete set of 25 bulletins on the First Principles of Grinding. They're free. Address The Carborundum Company, Niagara Falls, New York.

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ELECTRONICS NOW PAST GADGET STAGE

"Electronic devices in industry should not be of the nature of gadgets attached to some piece of equipment but rather must be engineered as a closely knit part of the whole," declared William C. White, head of the Electronics Section of the General Electric Research Laboratory, who spoke at the National Electronics Conference of which Illinois Tech was a sponsor.

"In most industrial applications," said Mr. White, "the electronic part of the apparatus comprises only a fraction of the cost of the whole. However, in such cases the electronic part of itself may not only be of limited use, but the rest of the equipment without its use is of little value." Accordingly, the engineering work on such equipment "must be done by men who are familiar with all of the special conditions involved in the particular industry in which the apparatus is to be used, and this factor cannot be supplied by a radio engineer or someone simply familiar with the electronic principles involved."

He warned that "the successful use of electronic devices in industry is based upon giving better results than other methods, or because the engineering problem involved cannot be solved in any other way. Where glamor has been responsible for putting to work some kinds of electronic devices, the chances are almost 100 per cent that these are misapplications rather than progressive steps. There is reason to believe, for instance, that in a few cases electronic high-frequency heating is today being employed in applications where former types of electrical heating would give satisfactory results and do it at lower first cost, higher efficiency and lower operating expenses."

Without the stimulus of war, he stated, years may elapse between the laboratory development of a good idea and its active commercial utilization. "As a result of the war, however, many new electronic devices have progressed from the idea stage to actual use in a remarkably short period of time, sometimes only a matter of months."

Two of a number of reasons for this, he said, are that "in place of the deadening mental attitude that accompanies depression, there is instead the atmosphere of energy and a determination to get results and get them quickly. In place of the normal feeling of resistance to change there is the certain knowledge that unless we get ahead and keep ahead of our enemies we are licked. Thus, necessity for change and improvement becomes a very part of our existence."

Millions of man- and machine-hours and millions of pounds of critical materials have been saved since Pearl Harbor by the use of industrial electronics, said Mr. White.

"No single kind of industrial electronic equipment," he continued, "has contributed more to the building of war machines than resistance welding control. It is being used to fabricate aluminum and many new and special alloys which have come into common use. The high quality of welds required to stand the abuses of wartime operations, particularly aircraft, is obtainable only with the precision timing and heat control offered by electronics."

RESEARCH STAFF TO AUDIT MEXICO

An intensive technological survey of the resources and development of Mexico will be made by Armour Research Foundation at Technology Center at the request of the Banco de Mexico, it has been announced by Harold Vagtborg, director of the Foundation.

Dr. Francis Godwin, assistant director of the Foundation, will head the study. Dr. Godwin was in charge of a similar project made in Argentina in 1942, in the interests of more balanced trade relationships and increased technology in South American industries.

Groundwork has already been started here, Dr. Godwin points out, with a staff under his direction planning to leave for Mexico City about November 1.

The request for the project came from Dr. Eduardo Villasenor, director general of the Mexican bank. Dr. Villasenor is also president of the Mexican Inter-American Commission. It grew out of conversation between Vagtborg and Maurice Holland, New York, advisor to the Foundation and formerly with the National Research Council.

Dr. Godwin says the purpose of the project is to "make a technological audit of Mexican industries, both existing and potential with special emphasis on basic fields.

"Hides, leather, solid fuels and by-products, fibers and their industrialization and all types of forest products as well as other industries related to these fields will come in for special attention."

He added: "We will endeavor to aid in pointing ways in which Mexican products can be made more generally useful in world markets and in aiding the United Nations' war needs until the end of the war with Japan. We are interested in the general postwar development of the republic of Mexico and in increasing their home technological development, with a view to more balanced hemispherical industrial economy."

In addition to the field staff sent to Mexico by the Armour Research Foundation, much of the research will also be done in the Technology Center laboratories of the Foundation in Chicago. Plans at present call for a number of Mexican scientists to be brought to Chicago to learn the latest research methods in order that they may further augment Mexican technology in starting new projects after their return to Mexico.

NEWS BUREAU HEAD CHOSEN

Frank E. Wheeler has been appointed as the new director of the IIT News Bureau. He replaces Paul O. Ridings, who recently left the Institute. He assumed his duties on October 2.

Wheeler was the assistant night telegraph editor of the Kansas City Star. He is a journalism graduate of Marquette University. He has also received a degree at the Wisconsin State Teachers College. He did graduate work in journalism at both the University of Missouri and the University of Wisconsin.

Wheeler was on the staff of the Milwaukee Journal from 1932 to 1934; for the next two years he was night editor of the Dubuque Telegraph Herald.

He served as the principal of a high school in Arena, Wisconsin in 1936-37. After leaving this post he became city editor of the Commonwealth Reporter of Fond du Lac, Wisconsin. Two years later, in 1940, Wheeler accepted the post of director of public relations and publicity at the Kemper military school in Missouri. Last year he became managing editor of the Boonville Daily News, and four months ago he started on the Kansas City Star.

He is 31 years old and is a member of Sigma Delta Chi, journalism professional fraternity. He is married and has one child.

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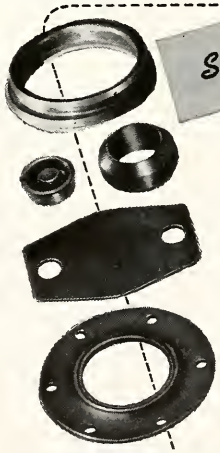

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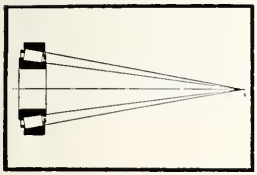
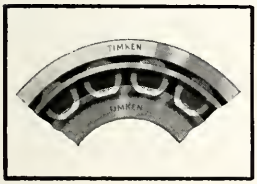
Timken introduced the tapered principle over 45 years ago to obtain an anti-friction bearing with the ability to carry radial loads, thrust loads or any combination of the two. During the ensuing long period of engineering development and experience, a constant refinement of design has taken place, making the Timken Bearing of today supreme in performance.

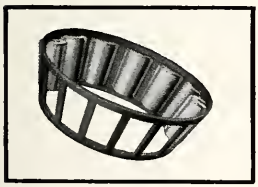
Here are the three most important features exemplified in the design of the Timken Bearing.



1. TRUE ROLLING MOTION: This basic necessity is assured by making all lines coincident with the tapered surfaces of the rollers, cup and cone, meet at a common apex on the axis of the bearing, Figure 1. True rolling motion always has been incorporated in the Timken Bearing.



2. POSITIVE ROLLER ALIGNMENT: During the development of the Timken Bearing, as speed, load and accuracy requirements increased, various methods were used to stabilize the rollers and prevent them skewing in the raceways. The solution was found in establishing wide-area contact between the large ends of the rollers and the undercut rib of the cone, thus assuring constant and accurate roller alignment around the periphery of the raceways. The light areas on the ends of the rollers in Figure 2, show contact of rollers with undercut rib of cone.



3. MULTIPLE PERFORATED CAGE: All the openings in the Timken Bearing cage, Figure 3, are stamped out in one operation by means of multiple perforating dies made to extremely close precision tolerances. This assures exact center-to-center spacing of the rollers around the periphery of the raceways, so that every roller takes its full share of the load when the bearing is in operation.

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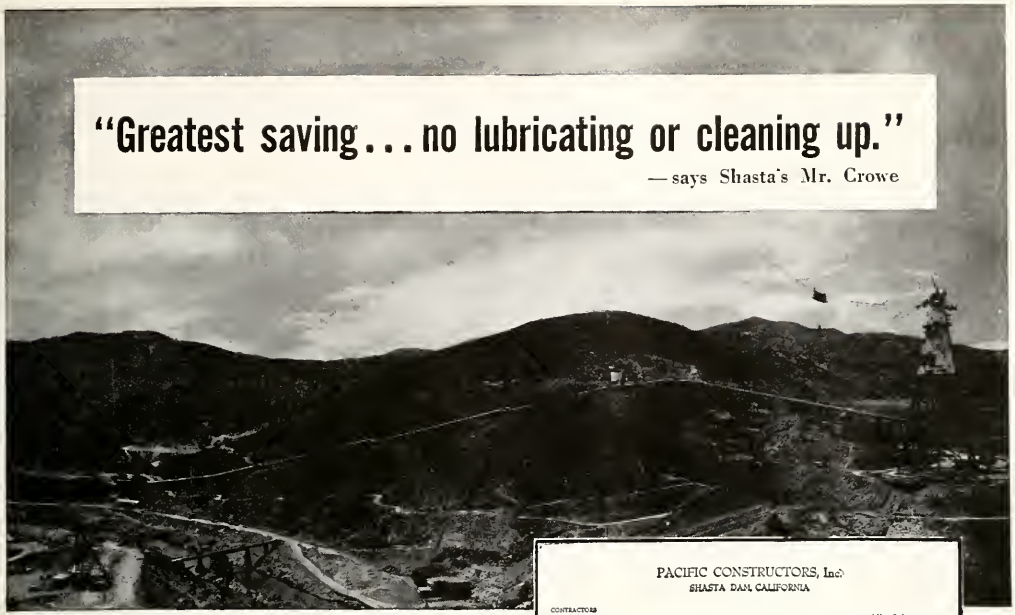

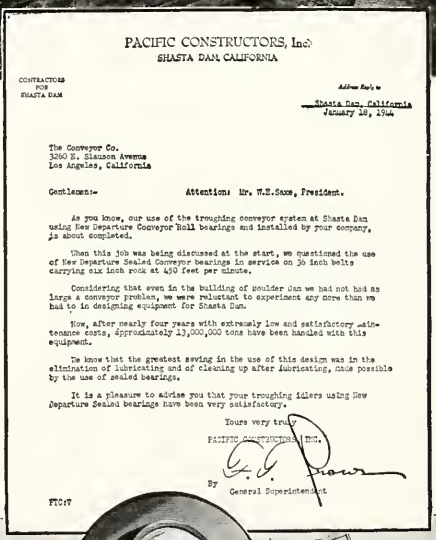

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CONTRACTORS FOR SHASTA DAM

Address Reply to
Shasta Dam, California
January 18, 1944

The Conveyor Co.
3260 E. Slauson Avenue
Los Angeles, California

Gentlemen: Attention: Mr. W.E. Sawe, President.

As you know, our use of the troughing conveyor system at Shasta Dam using New Departure Conveyor Roll bearings and installed by your company, is about completed.

When this job was being discussed at the start, we questioned the use of New Departure Sealed Conveyor bearings in service on 36 inch belts carrying six inch rock at 450 feet per minute.

Considering that even in the building of boulder Dam we had not had as large a conveyor problem, we were reluctant to experiment any more than we had to in designing equipment for Shasta Dam.

Now, after nearly four years with extremely low and satisfactory maintenance costs, approximately 13,000,000 tons have been handled with this equipment.

We know that the greatest saving in the use of this design was in the elimination of lubricating and of cleaning up after lubricating, made possible by the use of sealed bearings.

It is a pleasure to advise you that your troughing idlers using New Departure Sealed bearings have been very satisfactory.

Yours very truly,
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By G. E. Brown
General Superintendent

FIG:F

THE last link in the 10-mile Shasta Dam conveying system is a mile and a half unit made by the Conveyor Company of Los Angeles, using 17,500 New Departure Self-Sealed Ball Bearings of two types.

For nearly four years this system has handled 13 million tons of rock as big as 6 inches in diameter.

The satisfactory service obtained is proof that these self-sealed "Lubricated-for-life" ball bearings are not only equal to the job but effect great savings in time and lubricant.

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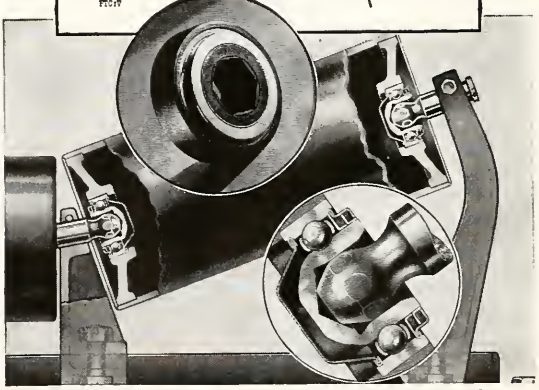

Bearings are lubricated for life. Shafts and bearings designed to prevent cramping or slippage. Units easily set up.

(Continued from Page 44)

who are thoroughly familiar with their work. Where changes are made by the home owner himself, he should determine before he begins remodelling, what the safety requirements may be, from persons who do know.

On the farm, the common causes of fire are well known: defective chimneys and heating equipment, sparks on flammable roofs, lightning, improper handling of hay, misuse of electricity, careless smoking and use of matches, and improper storage and use of flammable liquids. Study of protection standards would focus attention on proper installation of chimneys and heating devices. Fire retardant roofing would eliminate the possibility of fire from the spark hazard. The handling of hay, installation of electrical devices, carelessness in smoking and the handling of flammable liquids are matters that require the education of the farmer in some very common sense matters.

In attempting to cover a field as broad as that involved in an over-all fire protection program, it is not possible to dwell in any great detail upon remedies for specific conditions. In the home and on the farm experience has indicated to a fairly certain degree the hazards that generally are found in these classes. Industrial plants, because of their great variety, present problems that require special study for every unit, have problems that are unlike others and recommendations at once place may not be applicable elsewhere. In a broad sense industry is becoming more fire protection minded with the realization ever present that any prevention of loss is a direct saving to them. It has been repeatedly stated that any loss because of fire or other casualty even though entirely covered by insurance produces an intangible loss that is not recoverable in money.

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(Continued from page 28)

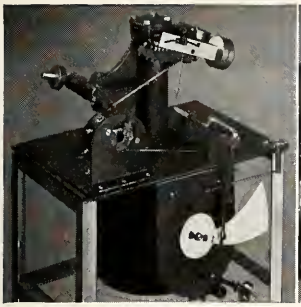
assumptions and so has become aware of the character of its own conclusions, does not remotely resemble the rigid body of mechanical dogma that old style humanists generally have in mind when they are attacking "science."

Professor Muller's statement of the aims of general semantics is brief, but excellent. He is not uncritical of Alfred Korzybski and finds in *Science and Sanity*, among other things, too sharp a differentiation made between men and animals, insufficient attention paid to "primary biological drives," traces of "rationalistic excess" that result in a tendency to "tolerate" rather than understand poetic and artistic processes. Nevertheless, his objections are tempered by his full recognition of the fact that general semantics is an open system, "consciously dated Science 1933," and therefore inviting addition, modification, qualification, and further development.

"Science, the author of our world," says Professor Muller, "is still a stranger here itself." It need not be. I personally wish that every philosopher, preacher, teacher, literary critic, and moralist would read this book. It would dispel at once a great deal of pessimistic nonsense about the "moral bankruptcy" of the modern world. Scientific and humane values are complementary to each other, as Professor Muller says, not opposed: "Literary men who oppose the 'merely' practical values of science to spiritual values have essentially the same attitude as ladies who just love culture. All savage societies had spiritual values; but there has been and can be no civilization without at least the rudiments of science."

On the other hand, "The very triumphs of science only accentuate the further need of literature. . . . With its immense intricacy, modern society is obviously dependent upon the efficient system of communications that science provides. With its immense heterogeneity, it also has especial need of an art of communication, a full and moving expression of the common meanings that hold a society together; and literature can not only realize the real but socialize it, effect not only communication but communion. . . . And here the extremely difficult problems forced on literature are also the great opportunity for literature. It can assimilate the meanings that science merely formulates, fuse them with older and deeper meanings, naturalize and humanize them. It can lead from a logical consistency to a vital coherence, from a logical synthesis to a vital harmony. It can help men really to own the world created by science."

This will appear to be too ambitious a claim for literature and the arts only to those who are unable to accept Kenneth Burke's statement that art is "a remarkably complete kind of biological adaptation." Muller with Burke, regards art as "a consummation of the processes of adaptation by which living organisms seek constantly to maintain their integrity and equilibrium amid the stress of constant flux and change." The art-for-art's-sake boys and those who talk (as Allen Tate does) of the "radical discontinuity" between the "physical" and the "spiritual" realms will deplore Professor Muller's conclusions, of course. They always see red at any talk about "adjustment" or "adaptation" anyway. But the art-as-adaptation theory (and here one would like to add, with Korzybski, "for a symbolic class of life") is the only modern statement of the *raisons d'etre* of the artist's activity that, strictly speaking, makes sense. The devotees of beautiful letters had therefore better get used to it.



Meter assembled as one unit on rack ready for calibration.

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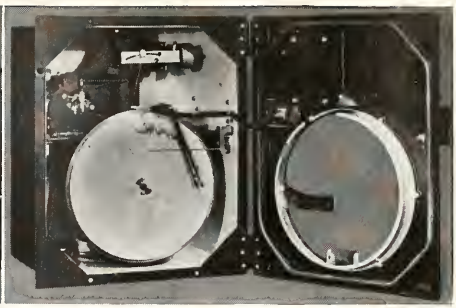

Meter with door open showing accessibility of all adjustments and working parts.

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The entire operating mechanism is housed in a rugged steel case and can be easily removed as a single unit by merely loosening two anchor bolts and disconnecting the two air connections. The meter may be either wall mounted or flush mounted on a steel panel. *Write for Bulletin No. 420.*

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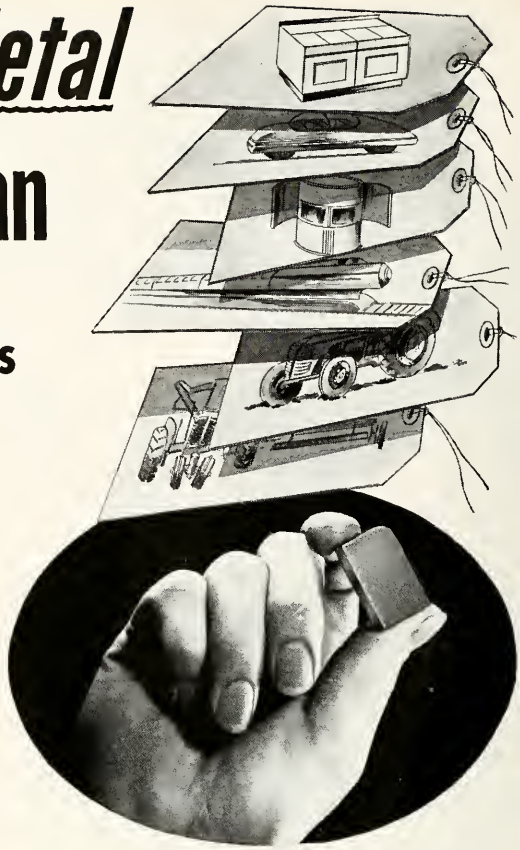

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It started U. S. tanks rolling

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For the coming "battle of costs"

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It has the *super-hardness* needed to handle modern metals. It works at speeds once thought impossibly high. It slashes machining costs—commonly doubles or triples the output of men and machines. It may well write the price tags in the coming "battle of costs."

Manufacturers in every field are invited to take full advantage of Carboloy engineering, experience and facilities in planning for the race to get better products to market, at lower cost, after the war.

CARBOLOY COMPANY, INC., DETROIT 32, MICHIGAN

CARBOLOY TRADE MARK

CEMENTED CARBIDE
THE HARDEST METAL MADE BY MAN

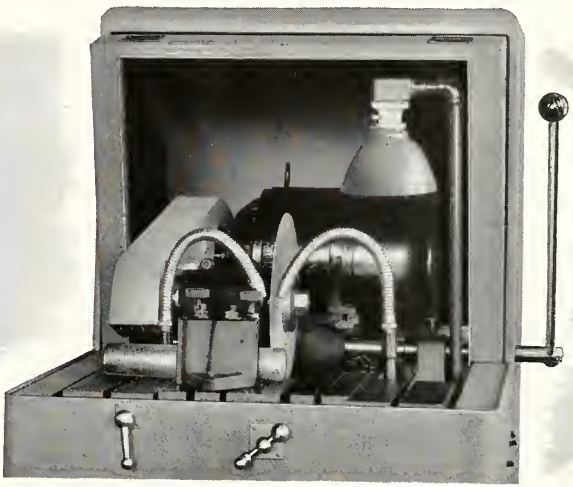
Buehler ABRASIVE CUT-OFF MACHINE

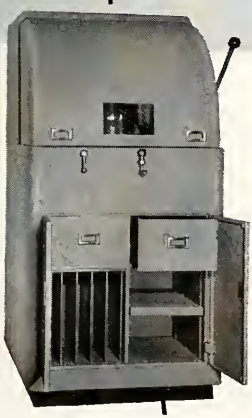
...for the Metallurgical Laboratory

Completely enclosed—full protection for the operator

Fast cutting

Smooth operating





Model 1000

The Buehler Cut-off Machine No. 1000 is a solidly built heavy duty machine free from vibration and side play with capacity for cutting specimen sections up to 3½".

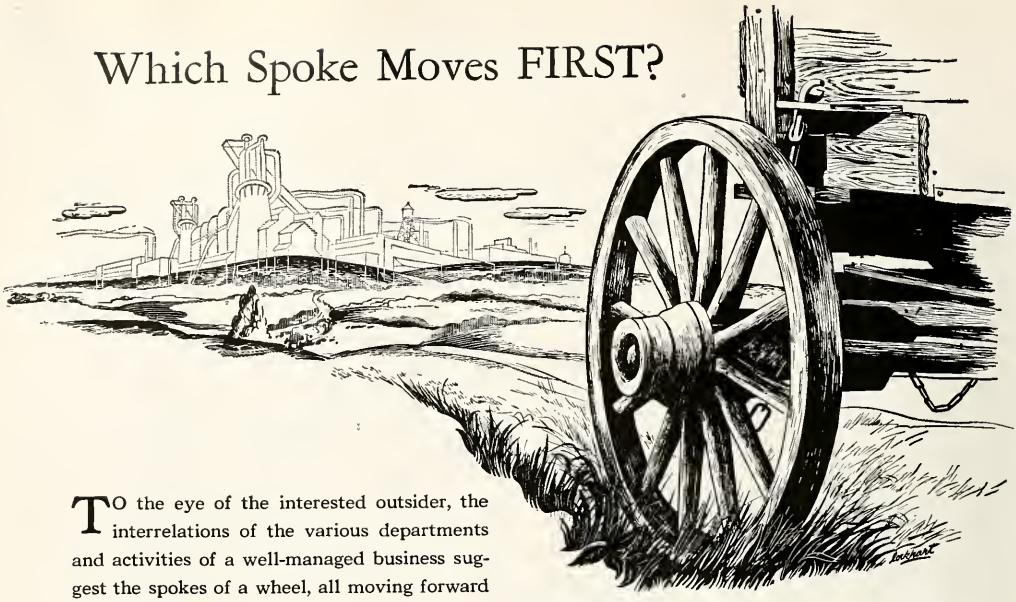
Cutting is done on the front of the wheel and is controlled by a convenient outside lever. With the cover closed, the cutting operation can be viewed through a heavy wired glass window. Regular equipment includes 3 HP totally enclosed ball bearing motor 1750 r.p.m., 220 v., 60 cycle, AC, 3 phase; pump motor ¼ HP, 220 v., 60 cycle, 1 phase; six cut-off wheels 12"x3/32"x1¼". Wheels not in use are stored in a spacious compartment in the base, which also contains a removable sludge collection chamber. The self-contained cooling system provides a flood of water for cool cutting. Overall dimensions 31"x47"x64". Shipping weight 1400 pounds.

The Buehler line of specimen preparation equipment includes . . . .
CUT-OFF MACHINES • SPECIMEN MOUNT PRESSES • POWER GRINDERS
EMERY PAPER GRINDERS • HAND GRINDERS • BELT SURFACERS
POLISHERS • POLISHING CLOTHS • POLISHING ABRASIVES

Buehler Ltd.
A PARTNERSHIP

METALLURGICAL APPARATUS
165 West Wacker Drive, Chicago 1, Illinois

Which Spoke Moves FIRST?



TO the eye of the interested outsider, the interrelations of the various departments and activities of a well-managed business suggest the spokes of a wheel, all moving forward in perfect unison.

Wise Management is well aware that production and distribution, prices and sales, costs and profits bear extremely close relationships to each other. But Management also knows that sound planning of future developments depends on intelligently selecting one department where improved practices should be initiated in order to produce the greatest general benefit.

Industry's new objective, frequently stated, is to make more goods, better goods, and sell them cheaper. Obviously, this entails high efficiency in every phase of the operation, but more especially in production. Increased efficiency in production is important, because improvement there will also lower costs, permit price reductions, stimulate sales and increase profits.

Handling and preparation of materials, and transmission of power are fundamental factors in manufacturing, that in many instances are susceptible of being made much more efficient. Link-Belt experienced engineers working with every type of industry have led the way in the development of scientifically designed, precision built power transmission and conveying machinery. Manufacturing a complete line including all recognized types, Link-Belt recommendations are sound, scientific and impartial. Our experience and advice are at the free disposal of your consultants, engineers and production executives.

In your planning for tomorrow, consult Link-Belt on materials handling, preparation and power transmission machinery, to help increase production efficiency, improve quality, reduce costs. Write today!

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"THE BACKBONE OF MASS PRODUCTION"

LINK-BELT

CONVEYORS...CHAINS...MATERIALS HANDLING and POWER TRANSMISSION EQUIPMENT

Chicago Plants · Indianapolis Plant · Ordnance Plant · San Francisco Plant

10% More Output
WITH 52% LESS HELP!

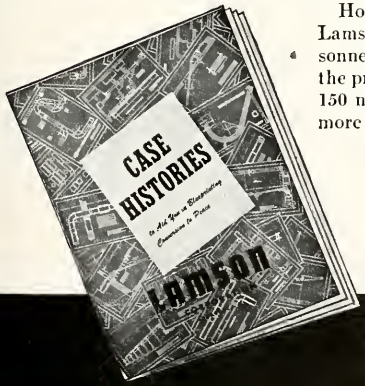
Springfield Armory Photos

Another example of the increased efficiency made possible by

LAMSON
Conveyors

★ When orders were issued to expand production of Garand rifles at the Springfield Armory, it became necessary to install a system of progressive manufacture, in place of the old, manpower-consuming method of hand-trucking from one operation to the next.

How well this was achieved is shown by the fact that after Lamson Conveyors were installed, in one department alone personnel was reduced from 54 to 26—and output increased 10%! On the production line turning out a single part (the cartridge receiver) 150 miles of walking per day were eliminated, releasing 30 men for more productive work!



In our new booklet "Case Histories to Aid You in Blueprinting Conversion to Peace" Lamson engineers present actual examples of the part played by Lamson Conveyors in streamlining production, eliminating manual handling and back-tracking. A complimentary copy will be promptly mailed you if you give your college and class.

LAMSON CORPORATION

Makers of Conveyors and Tubes

950 Lamson St., Syracuse 1, N. Y.

Established 1860

DIAMOND TOOL COMPANY NOT INC.

SHELDON M. BOOTH, President

Executive Offices and Factory ★ 938 East 41st Street ★ Chicago, Illinois

15 Factory Branches ★ Mill Supply Jobbers Everywhere

Sole Producers of—DTCo ★ LOC-KEY-SET ★ RE-SET-ABLE ★ BIG-HED—DIAMOND TOOLS

TRADE MARKS REGISTERED U. S. PAT. OFFICE

MOUNTED DIAMOND DRESSERS IN STOCK—READY FOR SHIPMENT

"C" Tools contain Common Quality Diamonds. Price $12.00 per carat. (Weight stamped on tools)
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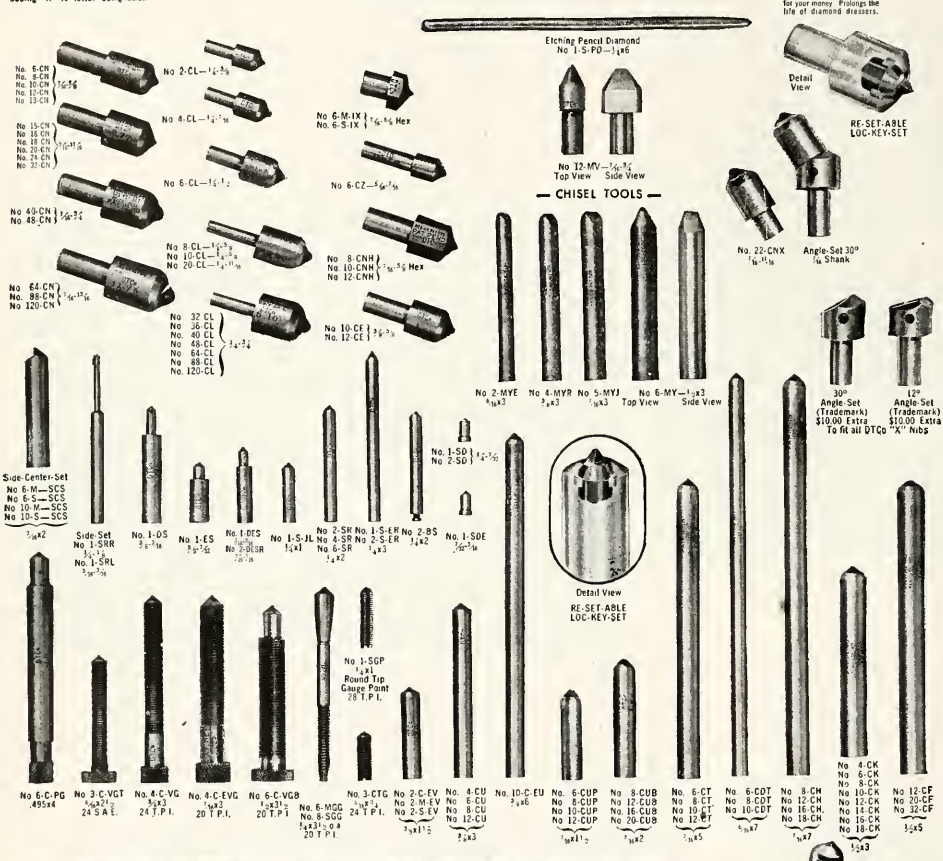
Minimum price of $5.00 is charged for small fractional carat tools. All prices are net..

Any Nib Tool is obtainable with short shank (7/16" long) by adding "X" to letter designation

All DTCo Tools are LOC-KEY-SET

RE-SET-ABLE means more for your money. Prolongs the life of diamond dressers.



RESETABLE LOC-KEY-SET RE-Setting $1.00 each tool. Mailing envelopes Free to Victory Plants, Grinders' instruction card free.

INSTRUCTIONS FOR ORDERING: Number of each tool pictured is eight times the diamond size contained in tool, and is two times the diameter of grinding wheel each tool is suited for. Example—For ½ carat number of tool is 4, and it is suitable for 2-inch wheel; for 3 carats number is 24, suitable for 12-inch wheel. NOTE: Above recommended sizes are for heavy production and include an added 50% safety allowance. For light work add ½ diameter to recommended wheel size. Diamond weights are stamped on all tools where space permits. Form Tool Diamonds: Special tools made from customers' prints and specifications. Reprints of this presentation furnished on request.

DIAMONDS for PRODUCTION

"Talking It Over" painted by Rudolf Wetterau

Home

Home is a lot of little things—the way you want 'em. A certain chair, and the ticking of a clock, the smell of what's on the stove, your old hat, and good friends.

And among these is a pipeful of tobacco, and plenty of time to enjoy it.

Kaywoodie Pipes are part of this picture. When the work is done, when the slugging is over, when you've sweat it out successfully, you'll have the finest pipe that money and experience and painstaking care can produce. Kaywoodie promises you that.

A Kaywoodie takes years to make, and is, we believe, the mildest, coolest, pleasantest form of smoking. This is due to the Kaywoodie Briar which comes from the countries surrounding the Mediterranean Sea (and only from there). You can't rush it, or mass-produce it, or short-cut it. After it has grown, it has to be seasoned and mellowed, aged and tempered, so it will draw the goodness from tobacco, and yield a cool, smooth, delicious smoke . . . a smoke free from trouble, with the distinctive "Kaywoodie Flavor."

Yes, Kaywoodie is, and will be, one of the things worth while in your home.

War Bonds come first

Flame Grain Kaywoodie "Bulldog" Shape No. 128 $10

Kaywoodie Company, New York and London
In New York, 630 Fifth Avenue

ILLINOIS TECH ENGINEER

AND ALUMNUS

December, 1944

Through a Glass...Darkly

Today new materials eclipse many of the old familiar ones that once were thought indispensable.

Synthetic rubbers, for example, replace natural rubber in scores of familiar products. Yet the future of synthetic rubbers in many important applications—tires, for example—is still a matter that only can be seen now "as through a glass darkly." Success depends not only on progress in synthetics themselves but also on the development of new and better processing materials.

A long step forward was taken when Furnace Type Carbon Black, a combustion product of natural gas, was shown to reduce greatly the tendency of Buna S rubber to generate destructive heat in heavy-duty tires. Lower heat generation means greater strength and longer life.

To help meet the great and growing demand for this type of black, Witco has erected in double-quick time a large new plant at Sunray, Texas, and put it into full production. CONTINEX FURNACE TYPE CARBON BLACKS, produced in this new plant, are today stepping up the speed and increasing the safety of many types of mobile military equipment by helping to improve the quality and stamina of the tires on which they ride.

Meeting demands for furnace as well as other carbon blacks is but one of the ways Witco serves the producers of rubber, paints, printing inks and other products. If you use chemicals, pigments, asphalt products or allied materials we invite you to submit your problems to our research laboratory and technical staff.

WITCO CHEMICAL COMPANY

MANUFACTURERS AND EXPORTERS

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Campus News

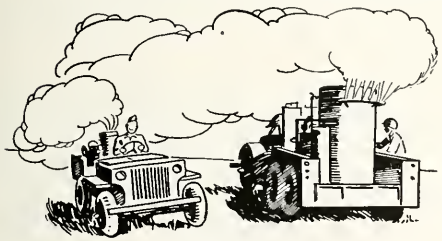
RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

CHRISTMAS DINNER IN THE TROPICS

IT is more than likely that many of the American boys in the South Pacific will have turkey for dinner this Christmas. It's not a military necessity, but it's good for morale, and high morale is an asset for any fighting force.

Good refrigeration equipment—the same sort that cools blood plasma, medical supplies, drinking water, and stores of ammunition—will make this possible.

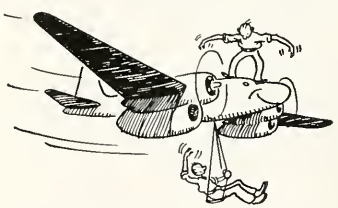
Recently, in collaboration with U.S. maritime and naval architects, General Electric engineers designed new, prefabricated refrigeration equipment for Victory ships which saves cargo space and materially reduces shipyard installation time. These refrigeration systems furnish 3½ tons of refrigeration for low temperature meat and fish rooms, and 3 tons of refrigeration at 40° F for vegetable, dairy, and thaw rooms. And six and a half tons is a lot of Christmas dinner in anybody's language.



JUNIOR

A LARGE smoke generator, principles for which were worked out by Dr. Irving Langmuir and Vincent Schaefer of the G-E Research Laboratory, produces a heavy blanket of smoke which has been used frequently to protect our men during landing operations. Now the Chemical Warfare Service has designed a smaller model.

"Junior" will fit into a jeep or a foxhole; can be carried by two men. With favorable wind conditions, it can blot out an area five miles long and 200 yards wide. The smoke will help the doughboys when the going is tough on jungle trails, mountain passes, and other vulnerable places.



NO STREAMLINING HERE

MOST airplanes look smooth. But some are definitely "lumpy." The plane which General Electric calls its flying workshop is of the lumpy variety.

It cruises high over Brownsville, Texas, carrying engineers and new equipment. Many new aircraft products and systems built in the laboratories and experimental shops of General Electric receive their first trial by air in this strangely shaped plane. It's one way G.E. makes certain that its aircraft equipment can stand the rigors of high altitude flying. *General Electric Company, Schenectady, New York.*

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, every weekday 6:45 p.m. EWT, CBS.

The best investment in the world is in this country's future. Keep all the Bonds you Buy.

GENERAL ELECTRIC

953-96-211

Engineering Achievements in the Field

A veteran Pacific Pump—modernized and again ready for service.

Another Record Pumping Achievement for Pacific

BUILT with precision tolerances down to a third of a hair's breadth, this 4" 10-stage Pacific Hot Oil Centrifugal Pump took the terrific punishment of ten years' continuous service, in a large West Coast refinery, under pressures of 1750 pounds and temperatures up to 850° F. *Think of it.*

With forged steel outer case and chrome steel inner case and fittings, it poured out seething hot oil at the rate of 680 G.P.M. operating at 3450 R.P.M. It went into action in June 1933.

In November 1943, after a complete check-up, modernization and replacement of a few minor parts, this "stout fella" was declared good as new and sent back to the firing line for another long period of pumping efficiency.

Pacific Pumps are *tough*, and they take it! Engineered design and precision workmanship make such pumping records possible.

Twelve 6-cylinder 600 B.H.P. CLARK "Angles" in the Cotton Valley Recycling Plant, Cotton Valley, Louisiana.

Twelve 600 B.H.P. CLARK "Angles" comprise the compressor battery in the Cotton Valley Plant. The plant capacity is 150,000,000 cubic feet of gas daily which is supplied from 69 condensate wells.

"Two of the Dresser Industries"

PACIFIC PUMP WORKS ~ CLARK BROS. CO., INC.

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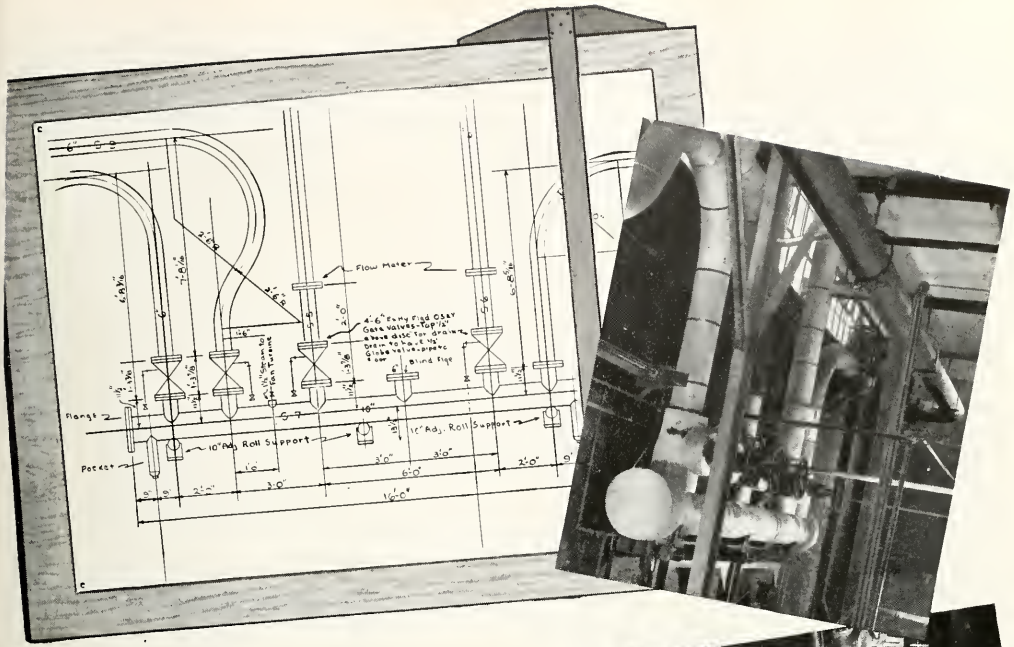


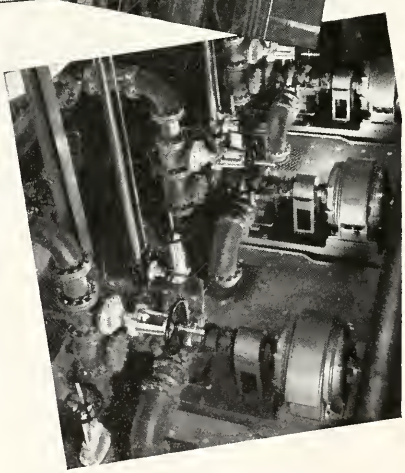
You can't take piping *for granted*

WHEN you draw a piping line on a blueprint—when you indicate a symbol that means a valve—remember that ultimately those lines and symbols will have to be translated into hard metal, and that those lines you draw will have much to do with determining the success or the failure of the engineering project.

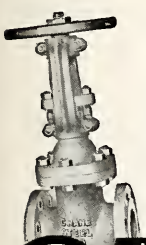
The parts that make up any piping system are many. But each one of these parts—the pipe, valves and fittings; the traps, joints and gauges; the flanges, unions, gaskets and insulation—is part of the complete Crane line.

When you are writing specifications, keep this fact in mind: Crane's single source of supply, Crane's experience, and Crane's reputation for high quality will do much toward assuring the success of the systems you design.

CRANE CO., General Offices, 836 S. Michigan Ave., Chicago 5, Ill.



HERE'S ENGINEERING DATA TO HELP YOU



Crane engineers have prepared several important books and treatises on piping systems. These include the Crane Catalog, *listing more than 48,000 piping items and containing valuable engineering data*—Piping Pointers Manual, *packed with piping information*—Flow of Fluids *and* Combating Corrosion, *two technical papers of value to any one laying out pipe lines. This material is available from the following persons in your school, for reference.*

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

BRANCHES AND WHOLESALERS SERVING ALL INDUSTRIAL AREAS

Alloy War-Steel reports for its physical

OWI Photo by Palmer, in an Allegheny Ludlum Plant

TESTING is an integral part of steel production at Allegheny Ludlum mills, because one of the "must" requirements for an alloy steel today is that it possesses—to the full—every one of the special properties desired by the user.

To help prevent failure of a part during operation, amazingly accurate machinery, worth thousands of dollars, is on the job at each Allegheny Ludlum mill, testing each lot of steel before it is shipped out to become fighting parts of planes, tanks, guns, ships or munitions. These steels *must* be right, for in the urgency of battles tremendous stresses are put upon the key parts for which alloy steels are chosen—and those parts must not fail when men's lives are at stake.

It is under such war conditions that Allegheny Ludlum steels have proved their worth. Right now they're helping to uphold the traditions of a free America, so that all of us may retain them in the future. When peace is restored, Allegheny Metal and other alloy steels will take their rightful place again in the enrichment of the post-war world.

But now—today—these metals are supporting the attack. Be sure you are also supporting our fighters, from your place behind the lines. Buy war bonds regularly! Top that ten per cent . . . buy them to the limit of your ability.

AL

STEEL FOR THE NATION'S WELFARE

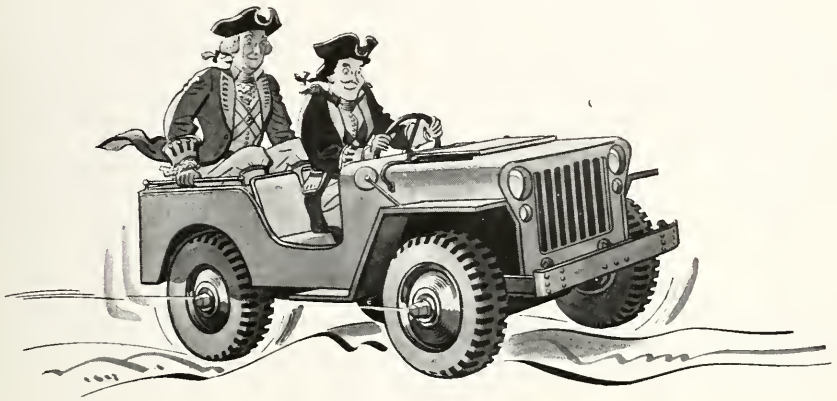
Allegheny Ludlum

STEEL CORPORATION

BRACKENRIDGE, PENNSYLVANIA

W & D A-931'

George Washington could have had a Jeep



All the raw materials needed to build a jeep were obtainable in George Washington's time.

Only the knowledge of how to obtain them, refine them and fabricate them into such a vehicle was lacking.

At Alcoa, we call this important ingredient "Imagineering". That's our handy word for letting imagination soar and then engineering it down to practical use. And this is the kind of a job that has a special appeal for young men interested in the future.

It's exciting and exhilarating work to let your imagination have free reign on the possibilities of light, strong aluminum—then engineer it down to earth. So there is plenty of opportunity in the aluminum industry for young men with imaginations that refuse to be limited by traditions.

There is almost no limit to imagineering with Alcoa Alloys in making things lighter, more attractive, more economical. All this adds up to making Alcoa Aluminum available in a greater number of ways, to a greater number of people at the lowest possible cost.

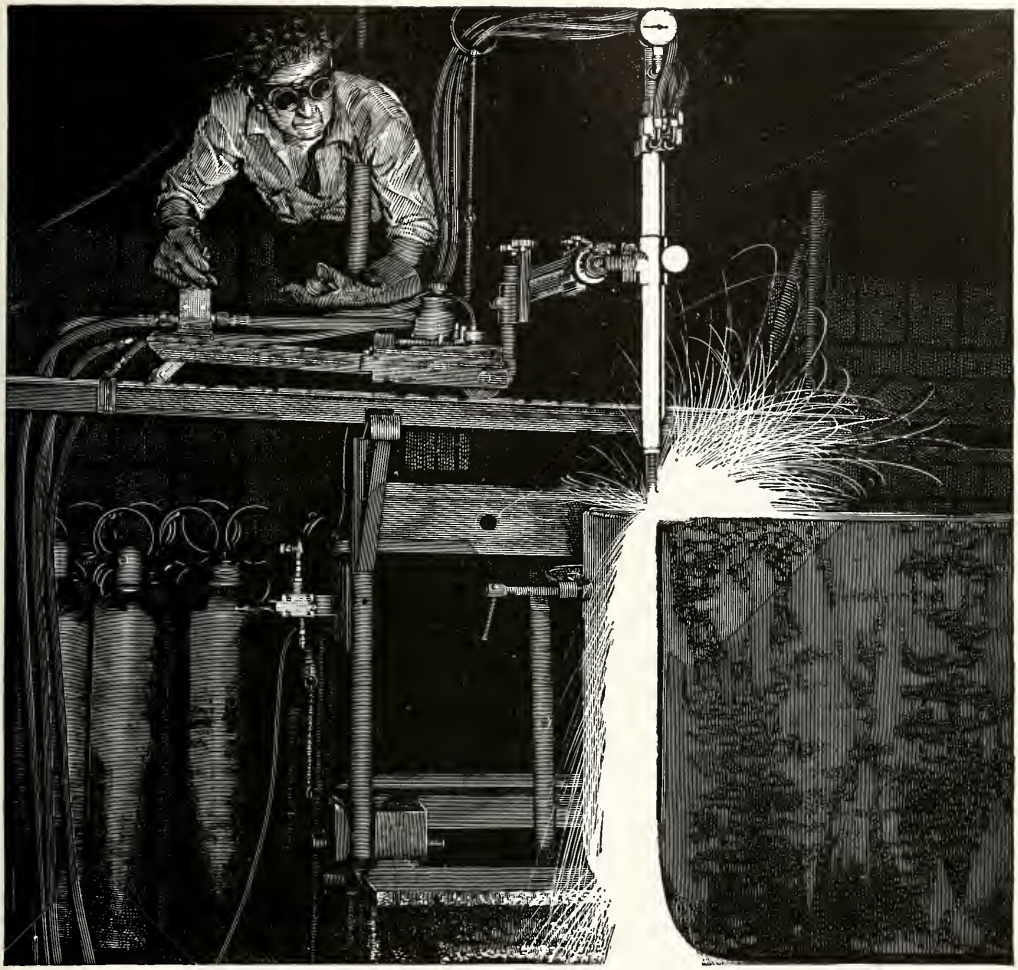
You can let your imagination soar on the future of Alcoa Aluminum and the part it will play in building a better world. It will be used in places and for things undreamed of now.

And we hope that many young men with vision will build their own future in the aluminum industry or in the many industries which will be using more aluminum than they have ever used before.

A PARENTHETICAL ASIDE: FROM THE AUTOBIOGRAPHY OF

ALCOA ALUMINUM

• This message is printed by Aluminum Company of America to help people to understand *what we do* and *what sort of men* make aluminum grow in usefulness.



Cutting 1000 Hours Off an Ordnance Schedule

Under the piercing heat of the oxy-acetylene cutting flame, thick metals like this 32" alloy steel block are shaped into parts for heavy weapons faster than ever before.

For example, the flame cutting operation shown here saves more than 1000 hours machining time in producing one heavy part for ordnance use. Similar valuable savings in time and labor are being achieved on hundreds of other war production schedules by this method . . . cutting steel up to 51" thick on a fast, production basis.

Air Reduction engineers have pioneered in the development of many machine flame-cutting methods to speed operations in war and peacetime industry.

If you would like to receive our informative publication "Airco in the News," we shall be glad to send a free copy. Write to Mr. G. Van Alstyne, Dept. C. P., Air Reduction, 60 East 42nd Street, New York 17, N. Y.

★ BUY UNITED STATES WAR BONDS ★

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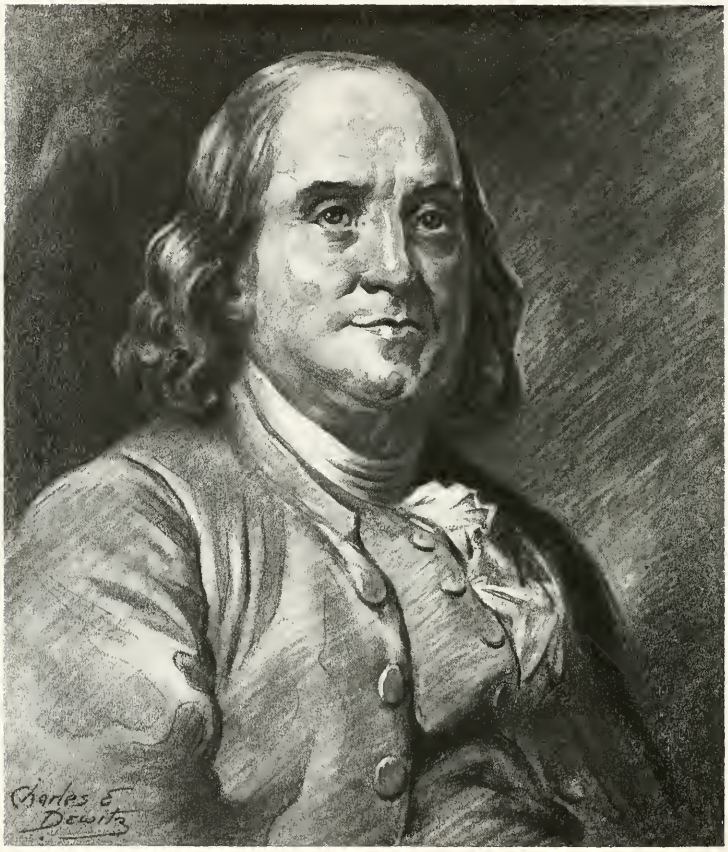
OXYGEN, ACETYLENE AND OTHER ATMOSPHERIC GASES • GAS WELDING AND CUTTING APPARATUS • CALCIUM CARBIDE ARC WELDING MACHINES AND SUPPLIES • CARBON DIOXIDE • "DRY ICE" • ANAESTHETIC AND THERAPEUTIC GASES AND APPARATUS

BENJAMIN FRANKLIN—1706-1790

Editor of "Poor Richard's Almanac"



Among the very foremost of those great figures who had to do in bringing about, and to successful conclusion, the American Revolution was the benign and mature personality of Benjamin Franklin. We may gain a more appreciative idea of his outstanding personality if we bear in mind that at the time of these stirring momentous days of the Revolution Franklin had passed the alloted "three score and ten years" of life time, when men generally are more or less conservative in dealing with affairs, but here was a man of most extraordinary powers, of seventy years who with burning ardor announced himself wholeheartedly and definitely "all out and out" for the revolution.

May it not be said in all truth that in the spirit of these tolerant principles as expressed and lived by that great exponent of liberty—Benjamin Franklin—are anchored the source and strength of our country,—and no force to the contrary, however, treacherous or powerful, can, nor shall overcome it,—it is impossible!

Contributors

Loretto Fox is news editor on the staff of the news bureau.

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JET PROPULSION

By

J. I. YELLOTT

Late in the evening of June 12, 1944, the flying bomb emerged from the realm of speculation and became a grim reality. On that night, the first of a great host of robot bombs invaded England. Unable to cross the channel themselves, and eventually incapable of repelling the invading forces of the United Nations when they in turn sallied across the channel, the Nazis gained the dubious distinction of innovating the actual military use of flying bombs. The success of their effort climaxed years of work but fortunately their attempts were both too little and too late. Had their robot bomb V-1 been perfected a year earlier, they might have delayed or even averted the invasion of France and their now inevitable defeat.

The unknown Nazi engineer who devised the simple but destructive buzz-bomb was one of a long line of inventors who have sought, with varying degrees of success, to harness the force of fluid jets to the use of man. To follow their history, the investigator must pursue a rather unusual course, since the literature of this field is to be found in unconventional sources. Perhaps the most useful of these is "Rockets — The Future of Travel Beyond the Stratosphere," by Willy Ley, which combines fact and fancy in a very unusual manner. In this volume, the author covers the subject from the fantastic literary efforts of Renaissance philosophers to the quietly practical activities of Captain Frank Whittle, inventor of the first feasible method of jet propulsion.

The first record of a jet propelled device in engineering history is undoubtedly the description of the "Aeolipile", which appeared in "Pneumatica", written by Hero of Alexandria in approximately 160 B. C. Whether Hero was the inventor or only the historian who recorded the invention of some anonymous mechanic is not known. The Aeolipile, however, has survived through the centuries in many forms. Its modern version, the lawnsprinkler, is familiar to all. Hero's Aeolipile was undoubtedly the first heat engine, and, as the predecessor of all jet propelled devices, it merits a brief description. It probably consisted of a bowl-shaped container which was partly filled with water and heated by a wood fire, as in Fig. 1. The steam rose through the supporting tube and entered the hollow spherical rotor through a trunnion. Two nozzles discharged the steam tangentially, and the reaction caused the rotor to spin vigorously in a direction opposite to that of the steam.

The thrust which caused the Aeolipile to rotate originates from the fact that a fluid stream exerts a force against any device which causes the momentum of the stream to change. The steam, entering the nozzles at low velocity and moderate pressure, accelerates as its pressure falls, and exerts a reaction which is found numerically by the following equation:

Force = (Mass discharged per second) × (change in velocity)

Hero's toy was the forerunner of the modern reaction steam turbine, although the delay of 2000 years between his disclosure and Sir Charles Parsons' reduction to practice, to use the patent lawyer's terminology, is one of the longest on record!

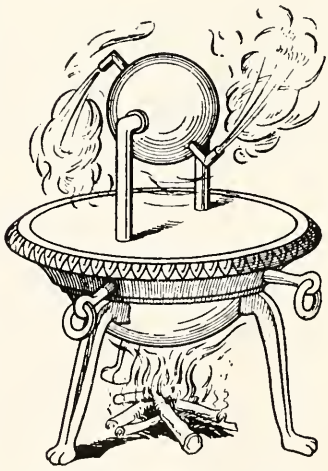

Fig. 1. Hero's Aeolipile is reputed to be the first apparatus for converting heat into mechanical power. It is the earliest demonstration of the principle of jet reaction.

In the dark ages which followed the fall of Rome, virtually all scientific progress ceased, and Hero's experiment was forgotten. In the early years of the seventeenth century, however, an Italian, one Giovanni Branca, devised a jet operated device, Fig. 2, which was the ancestor of the modern impulse turbine. Branca, who is variously identified as an engineer and a pharmacist, constructed a miniature power plant in which a wood fire generated low pressure steam in a spherical riveted drum boiler. A stationary nozzle directed a jet of steam on a vaned wheel, which was caused to turn because of the thrust of the fluid against the blades. In this case, the blades changed the momentum of the stream, and, in accordance with the same law which controlled the Aeolipile, the stream exerted a force against the blades.

The single wheel impulse turbine, found today in many applications which require high rotative speed and relatively low power, can thus be traced back to an ambitious individual who wanted to grind powders for compounding pills. The more modern version of the impulse turbine was re-invented by Gustav de Laval in 1886 when he needed a high-speed device to drive his cream separator. Most recently, this basic principle was employed by Dr. Moss in his turbo-supercharger and by Flight Lieutenant Frank Whittle in his turbo-jet propulsion system.

The first proposal for a jet-propelled vehicle in the European world was that of Sir Isaac Newton, Fig. 3, whose grasp of the theory of jet propulsion far exceeded his ability to transfer that theory into practical operation. In the year 1680, he suggested that a carriage be propelled by a jet of steam which would issue from a boiler through a controllable nozzle. The science of steam generation had not reached the point in Sir Isaac's day, however, where sufficient steam could be generated in such a unit to impart the thrust needed to start his carriage. Likewise, we now realize that land vehicles do not offer the best possible field of application for jet propulsion. It is interesting to realize, however, that most of the fundamental ideas required for successful jet propulsion of aircraft were originated more than 250 years ago.

The force of a jet was applied to military uses in ancient days in the form of a weapon which is today again very much in evidence. The rocket was undoubtedly invented by the Chinese, shortly after 1200 A. D., as a method of employing the gunpowder which some nameless Oriental had first compounded some years earlier. The military rocket has had a remarkable history, and, during the earlier years of the nineteenth century, it was used with devastating effect by the British navy against Copenhagen. Enshrined in the most inaccessible spot, vocally speaking, of our national anthem, it was such a rocket which shed its red glare on Fort McHenry and gave proof to Francis Scott Key that our flag was still there. The bombs bursting in the air over Baltimore's guardian fort were the explosive charges in these rockets, which, with a maximum range of some 3000 yards, were soon to be made obsolete by the rapid improvements in artillery. Oddly enough, the war rocket was diverted in 1824 from destroying to saving life by John Dennet of the Isle of Wight who obtained an English patent upon a line-throwing rocket for life-saving purposes.

Rockets fell into disuse after the War of 1812, and almost no military use was made of them in World War I. In the second World War, however, rockets have again become a potent factor, and, indeed, they have caused a major change in tactics. Once again, the resolute infantryman is a match for virtually anything which the enemy can send against him on the ground. The English yeoman with a longbow could destroy the knight in armor with a well-placed shaft. His remote descendant, the G. I. with a "Bazooka," can destroy even a Tiger tank with one devastating projectile. Rocket carrying pursuit planes can rout small naval craft, and ships as large as destroyers have been sunk by direct hits.

Most destructive of all rockets from the ancient Chinese "fire-arrows" to the present "Launcher, Rocket, Anti-Tank, Mark I," is the Nazi's "Revenge Weapon Number 2," which may finally convince the human race that war must at last be eliminated. This super-rocket is the logical product of experiments which have been carried out for the past twenty years in Germany. The technical details of its construction are not yet known, although its method of operation has been described. Fortunately, V-2 buries itself before exploding, while V-1 "lands" in a relatively gentle manner before it blasts its immediate vicinity into rubble.

The term "rocket" is properly applicable to the Fourth of July sky-rocket as well as to V-2, since they are both propelled by a jet of hot gas which issues from a combustion chamber, in which fuel is rapidly oxidized. The distinguishing character of the true rocket is the carrying of both fuel and the oxygen to burn it. The fuel may be either a petroleum derivative or an alcohol which is burned with oxygen, or it may be black powder which contains its own oxygen. In any case, the rocket is entirely independent of its surrounding atmosphere. It can carry an explosive charge, a bag of mail, or, conceivably, an explorer bound for Mars or the moon. It can travel at fantastic speeds which enable it to cover astounding distances in the few minutes required to exhaust its fuel supply. After reading reports of the fifty mile altitude attained by V-2, one hesitates to dismiss as impossible the interplanetary journeys proposed by authors with backgrounds as diverse as those of Jules Verne, Edgar Allan Poe, H. G. Wells, and Dr. Ley himself. A typical military rocket of World War II is shown in Fig. 4. Loaded with a potent high explosive, it is a very formidable projectile.

Only the rocket can penetrate the stratosphere and beyond, because it alone needs no air to support its wings or to feed its engine. Today, the V-2 falls upon England with sound-exceeding speed which gives no warning before it strikes. Tomorrow, some successor of V-2 may span either ocean and invade the United States at an altitude so high that, even if radar should reveal its presence, it could

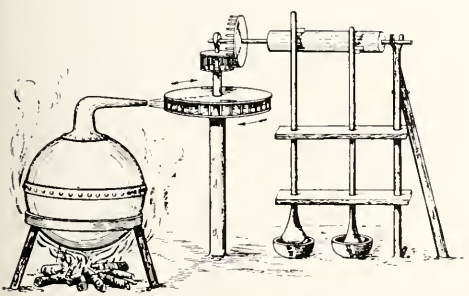

Fig. 2. The first proposal for an impulse turbine was made by an Italian, Giovanni Branca. The value of high rotational speed and reduction gearing was appreciated even in 1629.

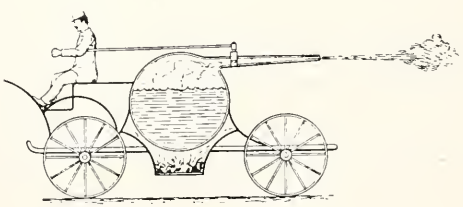

Fig. 3. Sir Isaac Newton, the English astronomer, and mathematician who propounded the laws of gravitation, invented a jet-propelled "horseless carriage" in 1680.

not be shot down because of its incredible speed. Radio control may even today give V-2 some degree of selection as to distance or direction and tomorrow some future Fuehrer might well choose Detroit or Chicago as his target. The rocket cannot be ignored as a future factor in warfare, for its limitations are still unknown. America's only sure defense against V-2, or V-102, is to make sure that it is never launched.

Jet propulsion, as the term is presently applied, refers to a system which draws in air or water, accelerates either fluid by an appropriate device, and discharges it at a relatively high velocity. As Hero discovered two thousand years ago, whenever the momentum of a fluid jet is changed, a reaction is exerted against the surface which causes the change. The rocket uses a form of jet propulsion, but it constitutes a special case in that it carries both fuel and oxygen with which to burn it. The jet propelled plane, however, carries only its fuel and relies upon some device to supply enough air to burn that fuel. The search for a suitable mechanism to maintain a steady flow of the vital air has led to two simple solutions, the "buzz-bomb" and the Whittle Turbo-jet system.

The distinguishing characteristics of the three systems are shown in Fig. 5. The rocket motor, A, is supplied with high-pressure liquid fuel which may be pre-heated in a jacket before it enters the combustion chamber. Oxygen is also supplied under pressure, and the fuel burns at a very high temperature, producing an extremely high velocity gas stream. Since the thrust of the rocket is equal to the product of the mass being ejected per second and the exit velocity, the jet can exert a very large force. In the largest rocket yet employed, the German V-2, the thrust must be at least several times greater than the reported fifteen-ton weight of the device. The fuel consumption rate of such a monstrosity, however, is correspondingly high, and V-2 must exhaust its supply in a matter of several minutes. Because of the incredible speed which it can maintain in the stratosphere, possibly 3500 mph, V-2 can apparently travel far enough in its brief flight to reach England from launching platforms well within the confines of the Third Reich. In addition, the rocket needs only to be powered during its rise to the top of its trajectory. Gravity will do the rest.

The principal use which the United States has made of rocket propulsion is jet-assisted take-off of aircraft. By attaching small rockets beneath the wing of carrier fighters, their take-off runs can be reduced by sixty per cent. Short jungle run-ways can also be used when rockets assist the plane's motor in bringing it to flying speed. It is reported that each rocket can develop 300 hp during the few seconds it is in operation. The burned out tubes can be dropped after they have served their purpose.

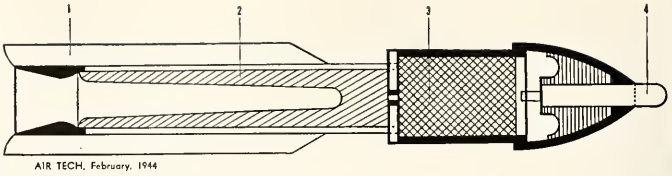

Fig. 4. The German aircraft rocket shell probably resembles the sketch below. Points indicated are, 1. Fins; 2. Rocket charge with center bore to increase burning surface; 3. High explosive charge; 4. Fuse is of contact type, exploding on impact and connection between rocket and explosive charges causes explosions when former is exhausted in rocket. Projectile weighs approximately twelve pounds, is thirty inches long.

The Nazi robot bomb and the Allies' jet-propelled plane both make use of continuous supplies of compressed air to keep their propulsion jets in operation. Although the technical details of these two systems will be treated in the second installment of this paper, it is appropriate to mention their methods of operation. The "buzz-bomb" employs the impact pressure of the air itself to charge the combustion chamber. By accelerating the robot to a speed of approximately 150 mph, atmospheric air is forced through the inlet grille G, past the reed-valves R into the combustion chamber. These inlet valves are apparently close relatives of a much happier German device, the reeds on a harmonica, for they operate as simple but effective one-way passages through which the air can enter but not escape. Low-grade oil fuel is injected into the Venturi-shaped spaces, V, and a hot wire or a spark provides adequate ignition. The hot gasses puff out of the tail pipe. As they leave, the pressure falls until the impact or "ram" effect again forces fresh air into the chamber, and the cycle repeats. This almost childishly simple device produces enough power to drive the flying bomb at speeds up to 400 mph, and for periods up to thirty minutes. Its thermodynamic efficiency is almost as atrocious as its indiscriminate destructiveness. Like Frankenstein's monster, however, it will probably bring more ultimate harm to its creators than to its victims. The lost English advocates of a soft peace for Germany were converted by V-1 into ardent followers of Lord Van Sittart. The score established by the robots in their first 80 days of operations was: dead, 5,817; wounded, 17,036; homes destroyed, 870,000. The Germans called it Vengeance Weapon No. 1.

The Whittle system of turbo-jet propulsion, C in Fig. 5, is a direct descendant of the turbo-supercharger which was invented by Dr. S. A. Moss during World War I. Air is taken in from the atmosphere and compressed by a high speed centrifugal blower. The compressed air then enters a combustion chamber where a liquid fuel such as kerosene is injected and ignited. The hot products of combustion, under moderate pressure, pass through a turbine stage, which extracts enough work to drive the compressor. The exhaust gases, still hot and under low but sufficient pressure, pass out through the exit nozzle at a velocity high enough to give the necessary propulsive thrust. The turbo-jet engine has only two moving parts, the compressor rotor and the turbine wheel. It can use any fuel which can be burned in the small combustion space which is available, and it can deliver full power within thirty seconds after it is started. In its

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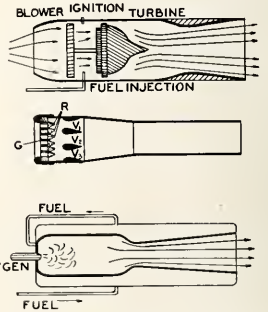


Fig. 5. Operating principles of (A) the Rocket Motor, (B) the "Buzz-Bomb," and (C) the Whittle Turbo-Jet system.

NEW ELECTRICAL MACHINERY LAB

By

E. H. SCHULZ

The increase in laboratory work in electrical machinery resulting from the Navy V-12 program and other war training programs made an expansion of the facilities in the electrical machinery laboratory necessary. The remodeling of this laboratory was made possible by a gift from a friend of the Institute. The remodeling was completed at a cost of $25,000, including the purchase of a considerable amount of equipment.

The purpose of the remodeling was to provide additional student capacity, to provide more pleasant surroundings, to provide greater flexibility, and to provide the maximum possible safety to personnel and equipment. The remodeling has provided the Institute with one of the most modern and complete electrical machinery laboratories to be found in any college. The test tables used in this laboratory are very elaborate and flexible. All of the machines are modern. A very complete list of motor controls is available. Most of the motor-generator sets are built in the form of dynamometers. Insofar as possible all equipment conforms with modern industrial practice.

To provide sufficient space, most of the old machines, which were relatively large, were removed and replaced with smaller and more modern machines. To improve the appearance of the laboratory, a new floor was installed, and an acoustical ceiling was moved from the old pre-radar laboratory to the machinery laboratory. The walls were repaired and painted and cable racks and equipment storage shelves were built into enclosed cabinets. Ventilating fans were installed. New fluorescent lighting fixtures were installed both to improve the appearance and to provide sufficient illumination to insure the maximum possible safety. The illumination level at table top height is thirty foot-candles.

Fig. 1. Test Table for AC-DC Motor Generator Set

The laboratory is now equipped with nineteen motor generator sets. These include:

1—DC series motor (5 HP) driving a DC shunt motor

5—DC compound motors (5 HP) driving DC compound generators (3 KW)

6—Synchronous machines (4—5 KVA, 2—12.5 KVA) Coupled to DC compound wound machines. (These may be used as an AC motor driving a DC generator or as a DC motor driving an alternator.)

3—Squirrel cage induction motors (5 HP) driving DC generators

3—Wound rotor induction motors (5 HP) driving DC generators

1—Sine wave generator set consisting of a DC motor driving a 60 cycle and a 180 cycle machine. (These machines are designed to give a very good wave form. By interconnecting the two machines a complex wave form of voltage may be obtained for demonstration and experimental work)

All of the DC-DC motor generator sets and the induction motor sets are mounted in dynamometer cradles so that torque may be measured directly. The series motor set is provided with an overspeed relay.

In addition to the above motor generator sets, a number of 3 and 1 HP motors are mounted as portable units with prony brakes. These machines are stored in the equipment storage cabinet when not in use. Fractional horsepower motors of various types are mounted with brakes and scales.

The switchboard installed in this

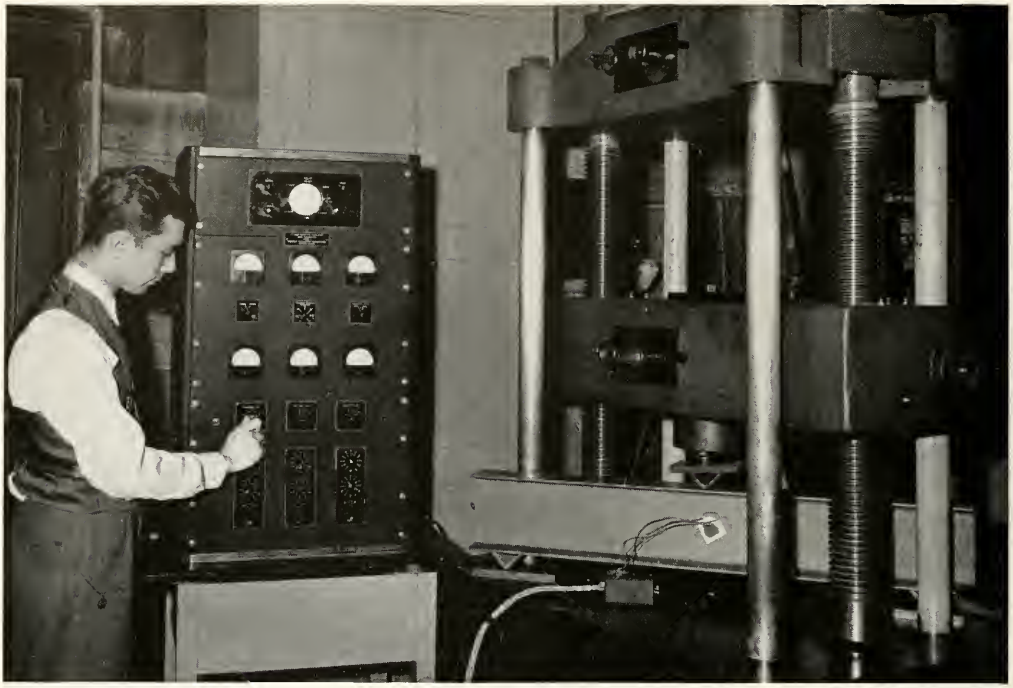


Fig. 2. Section of Electrical Machinery Laboratory Showing Switchboard

laboratory is a departure from the usual type of switchboard found in most college electrical laboratories. In most of these laboratories the switchboard consists of open knife switches and air circuit breakers mounted on black slate panels. The new switchboard in the Illinois Institute of Technology laboratory is of all steel construction with circuit breakers of the enclosed type. Its pearl-grey finish with colored jacks presents a pleasing appearance. A 115 volt DC supply, a 115/230 volt AC supply, and a 230 volt three-phase supply are fed to the various test positions from the switchboard through protective circuit breakers. In addition, trunk lines to various parts of the laboratory, to the battery room, and to the circuits laboratory terminate in jacks located in the switchboard. These trunk lines result in a flexible system of providing special voltages in various laboratories or for interconnecting equipment in various parts of the laboratory.

A very complete set of motor control equipment is provided in this laboratory. These controls are used in teaching night courses on control methods to people in industry requiring training of this sort, as well as in teaching the regular college courses.

Two very flexible panels are pro-

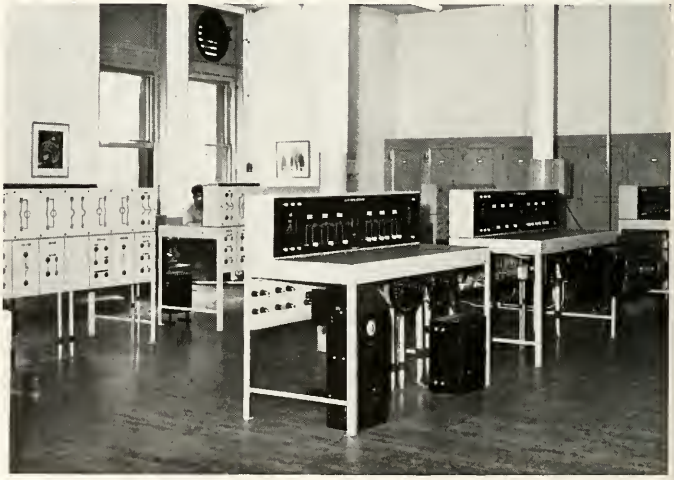


Fig. 3. View of East Section of Electrical Machinery Laboratory

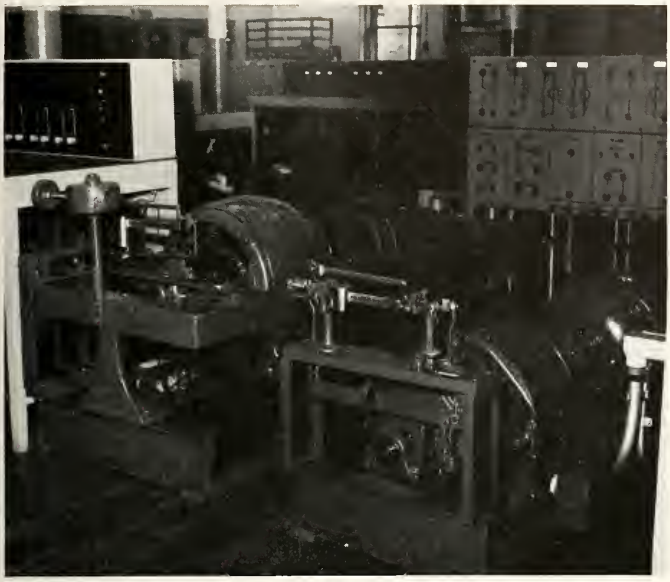


Fig. 4. Two Types of Dynamometers Used in Electrical Machinery Laboratory

vided for setting up any type of automatic AC or DC motor control. Students may use these panels to set up and study the operation of any type of control. A large variety of commercial equipment, both manual and automatic, is available. In addition, a thymotrol or electronic motor control, a Silverstat voltage regulator, synchronizing relays, an amplidyne positioning control, and others are available. The amplidyne is a DC generator used as a current amplifier. This unit has been of considerable use in the war effort in such applications as speed control and position control on warships.

To provide maximum safety and flexibility a new type of test table was designed by the electrical engineering department. The tables were built by the Standard Electric Time company. It is believed that these tables are the most elaborate of any used anywhere in college laboratories.

The test tables are built of steel and finished with pearl gray enamel. Masonite on the table top provides insulation and protects instruments from mechanical jar. The front panel is made of bakelite, while the rear panel is made of one-eighth inch steel. Rheostats and starting compensators are mounted under the table. Circuit breakers, ammeter switches, and binding posts for connecting instruments are provided on the front panel. The lower rear panel is equipped with jacks connected to the machine terminals, power supply, starters, and field rheostats. The upper rear panel is provided with jacks connected to the circuit breakers, ammeter switches, and potential terminals mounted on the front panel.

In connecting a machine for a given test, the student makes all of the circuit connections at the rear panel, placing circuit breakers where needed and connecting ammeter switches in the lines in which currents are to be measured. He then connects his instruments to the proper terminals on the front panel, and finally connects his circuit to the proper power source. The circuit is now ready for the test. All controls that must be manipulated are accessible from the front of the table so that all instruments may be watched while adjustments are made.

The dead front construction of all panels, the circuit breakers, and the ammeter protective switches provide the maximum possible safety. However, no amount of protective equipment will take care of all the possible errors that may result in an accident; hence certain rules of procedure are rigorously enforced. A combination of the safety devices and the enforcement of these rules should hold the possibilities of accidents to a minimum.

In the last few years the electrical laboratories have been provided with a considerable number of additional instruments. In addition to ammeters, voltmeters, wattmeters and others, new stroboscopes for measuring speed, slip, and torque angle have been obtained. Three industrial analyzers consisting of voltmeter, ammeter, wattmeter, and power-factor meter for three-phase measurements have been found very convenient in testing

(Continued on page 44)

Fig. 5. Amplidyne Position Control and Thymotrol Motor Control

NEW ILLINOIS TECH TRUSTEES

When the Board of Trustees of Illinois Institute of Technology met in October, five new members were elected to the board. The men are all successful business executives from Chicago and other middlewestern cities. They are: John L. Beven, president of the Illinois Central System; Louis B. Neumiller, president of the Caterpillar Co., Peoria, Ill.; Kenneth Parker, president of the Parker Pen Company, Janesville, Wis.; C. E. Stryker, vice-president of the Nordberg Manufacturing Company, Milwaukee, Wis.; and Harold Vagtborg, former director of the Armour Research Foundation.

J. L. BEVEN typifies the American success story, from messenger boy to president of a great industry. At the age of 12 years he became messenger boy for the Illinois Central railroad in Macomb, Mississippi, where he was born, February 17, 1887. It was natural for him to begin his career in the employ of the railroad because throughout his childhood he rode in the engine cab to the roundhouse with his father, a locomotive engineer.

He attended night school, on the nights he did not work, and advanced tediously up the ranks, from messenger, to file clerk, to chief clerk, to trainmaster, to superintendent of the New Orleans terminal, to assistant federal manager in Chicago, to vice-president, and to president in 1939.

The steadily widening horizon of Mr. Beven's activities is revealed by the fact that in addition to being the active head of the Illinois Central System he is president of the Chicago & Illinois Western Railroad, a member of the Board of Directors of the Central of Georgia Railroad, chairman of the board of the Peoria & Pekin Union Railroad, a director of the Terminal Railroad Association of St. Louis and chairman of the board of the Madison Coal Corporation.

LOUIS B. NEUMILLER, president of the Caterpillar Tractor Co., found success and recognition in his own home town, Peoria, Ill., where he was born January 14, 1896. After completing his education in Peoria grammar and high schools, he did general office work for a local grain company. In 1915 he entered the employ of the Holt Manufacturing company, which was one of the predecessors of the present Caterpillar Tractor Co. His first work was of a clerical nature in the drafting room, the department of which he later became chief clerk and then superintendent.

When the Holt Manufacturing company consolidated with the C. L. Best Tractor company to become the Caterpillar Co., Mr. Neumiller was named general parts manager. Successive promotions made him general service manager, sales manager, and director of industrial relations.

In 1937 his duties and responsibilities were broadened when as vice-president he was given administrative responsibility over the parts, service, traffic, and industrial relations departments. Four years later he became president of the company in which he had worked for 36 years.

Janesville, Wisconsin owes its place on the map to the Parker Pen company, which in turn owes much of its success to its president KENNETH PARKER. The son of the founder of the company, Parker was educated in France and Germany as well as the United States. Although he was a member of the class of 1918 at Brown university, he did not graduate. In his junior year he left college to join the navy air force, with which he flew as a pilot for two years.

As president of the Parker Pen company, he supervises all the promotion, leaving actual selling to his vice-president.

After he spent a year in the Lord and Thomas Advertising agency in Chicago, he joined his father in the pen business in 1919. Parker's interests have been along the lines of advertising, product design, research, and export merchandising.

In addition to his executive capacity at the Parker Pen company, Mr. Parker is a director of the Merchants and Savings Bank of Janesville.

CLINTON EVERETT STRYKER has had an active interest in Illinois Tech for many years, first as an Armour undergraduate and then

(Continued on page 58)

Beven Neumiller Parker Stryker Vagtborg

CHEMICAL DETECTIVES

By

LORETTO FOX

Since 1942 Dr. Martin H. Heeren has become the nation's foremost finder of missing chemicals through his chemical detective agency, the National Registry of Rare Chemicals, in the Armour Research Foundation. No chemical is too rare; no amount too small. If a pinhead quantity of some rare drug is available in an obscure laboratory anywhere in the United States, and a scientist needs it, Dr. Heeren can locate it for him.

A pharmacist would give up in despair if he were called upon to find any one of 6,500 rare or unusual chemicals which are the stock in trade of the registry. That task is all in a day's work for Dr. Heeren.

The Registry of Rare Chemicals is a clearinghouse for information on available sources of uncommon chemicals urgently needed for the satisfactory continuation or completion of research projects or similar activities. It is not a storehouse, but a large and well organized card catalogue of data; a card index that is invaluable to every research scientist, research foundation, and industrial research department in the country.

The registry came into being after Dr. Heeren, and other research men at Armour Research personally experienced the need of such an index. Early in 1942, the Foundation found a particular experiment stymied because of the lack of a small quantity of a chemical. Racing with time to complete important work for an insecticide manufacturer, they had to concentrate all their energies on locating the chemical, "1, 1-dichloro-1-nitro ethane," then an obscure compound. They received nothing but negative answers when they searched in chemical supply houses and private laboratories. After nearly a month had passed, they found the missing item, just in time to save the experiment from failure.

With the memory of this experience fresh in their minds and with the war rushing scientists into an inexhaustible field of new experimentation on vitally needed weapons, substitute materials and improvements, the director of the Foundation and Dr. Heeren conceived the idea of the Registry of Rare Chemicals. Considering the difficulty in finding that one compound, the compiling of a complete index of rare chemicals, seemed almost impossible. Dr. Heeren's approach to the problem is best told by himself.

Dr. Martin H. Heeren

"I wrote several of the country's leading scientists," he explained, "and all were enthusiastic over the proposal. They all agreed to co-operate. They sent lists of unusual chemicals in their possession, and finally the Registry's file grew out of bounds. In a couple of weeks I realized I had a full-time job on my hands."

It was apparent that scientists throughout the country shared the Foundation's need for such a file. Dr. Heeren explained the Registry and requested information on rare chemicals in a circular which he sent to about 2,500 industrial and educational laboratories. The favorable response was overwhelming. Along with lists of rare chemicals came requests for other rare chemicals. More letters went out; more requests were received. The number of file cases multiplied. The job, which will never be complete as long as science experiments and discovers, was under way.

Obviously, filing the items was a tedious task. To insure the best possible service to all who request information, the chemicals are filed and cross filed. Two systems are used, organic nomenclature and alphabetical. Dr. Heeren has discovered it is desirable to file each chemical under all of its different names. Once a chemist asked for sodium propionate. After a thorough search, Dr. Heeren realized that this so-called rarity was manufactured by hundreds of tons as an insecticide that hides under the trade name, "Mycoban."

The file contains the name, amount available, and location of the chemical. Some chemicals are valued at $1,000 a gram, but usually the owners supply them without charge, and expect the same consideration in return. Most of the chemicals are available in extremely small amounts, since they are ordinarily leftovers or by-products of completed experiments. Because the majority of requests are for small quantities the file registers chemicals obtainable in a few milligrams. The Registry lists only .1 gram of cozymase, used in nutritional research, and even less of leukotaxine.

The war has placed many new cards in the file. A number of compounds, although not actually rare, have been made scarce by the war. When located, they sometimes can be obtained by the carload.

Although Dr. Heeren is the director of the Registry, the files proper are kept by Mrs. Marie Trapp, while Dr Frances Knock, a chemist, is the technical supervisor. This carefully chosen staff is bound by the same obligation of confidential operation that governs all of the work of the Foundation. It is their responsibility to

make easily accessible cards that bear names like diiodohexamethyldiaminoisopropanol.

Correspondence received at the Registry contains the names of the great in science as well as the obscure: Industrial kingdoms such as DuPont, Standard Oil, Union Carbide, and the Abbott Laboratories, their work blocked by the absence of some uncommon chemical, have appealed to Registry of Rare Chemicals, housed in an unpretentious corner of the Armour Research Foundation for help. Unknown chemists, faced with the same situation resort to the same remedy—Dr. Heeren's card catalogue. Requests have come from each of the 48 states, South American countries, England, Australia, India and the Union of So. Africa.

Theoretically, it would be possible for a laboratory, after failing to find a rare drug, to manufacture. However, the complexity of these unusual chemicals requires special equipment, untold hours of labor, and other equally as rare chemicals. The Registry has simplified this process, simplified it down to a mere letter of request.

The letter is all that is required of the applicant; but Dr. Heeren's job is not always quite that simple. If information on the requested chemical is in the file, as it is in over 50 per cent of the cases, he sends the name of the owner and the amount available in an immediate response. Then it is up to the two involved parties to negotiate further business; the Registry has closed the case. When the Registry is asked for a chemical not listed in its files, the staff searches until the order is filled.

During the Registry's second year of service it was besieged by 5,000 requests for information concerning sources of uncommon research items. Of this total about half were filled immediately upon consulting the files or by telephone contact with various supply houses and other supplementary sources. An additional 25 per cent were filled through information furnished in reply to the notices placed in scientific journals and magazines. No inquiry is considered closed until the registry has supplied a source for the chemical sought. Requests which cannot be filled are filed in such a manner that they can be answered without delay as soon as a trace of the chemical is found. Often the information is unearthed several months later, but it is always forwarded to the original inquirer.

This service is rendered entirely without charge to anyone in need of information. The Registry makes no profit on the transaction. In rare cases, however, the buyer may desire to keep his identity unknown and the Registry transmits price information, the chemical itself, and the cash payment. The Registry accommodates buyer or seller in this fashion because many companies have secret formulas which could be deduced if a competitor knew the company wanted a particular chemical or had it in its possession.

Since the Registry files only rare drugs and chemicals and makes no profit on its work, it does not compete with drug and chemical houses. It does not register common stock drugs and chemicals.

Like all free agencies, the Registry has its share of cranks, and small boy amateurs who request dangerous ingredients. Other well meaning people offer for the files self-compounded chemicals accompanied by fantastic claims. Most flamboyant of these claims was an offer Dr. Heeren received of a chemical which according to the inventor would give mankind eternal life. However, Dr. Heeren's scientific background, as well as his sense of humor, forced him to decline the generous gesture.

But absurd or childish requests are in a small minority. The bulk of the yearly inquiries are from sincere chemists working in reliable laboratories, and government agencies. The Department of Agriculture, for instance, was in the midst of important war work on an experiment dealing with light diffusion, when the lack of a rare acid threatened to halt the job. Their own efforts failed and they turned to the Registry of Rare Chemicals. The Registry located a few grams of the substance in the laboratory of a professor at Vanderbilt University. Instead of the project losing weeks of valuable time, or being stopped entirely, it was completed ahead of schedule.

The Registry can take more than a little pride in its aid to wounded men on the battle front. Johns Hopkins university discovered that a rare chemical valuable in treating war wounds was no longer available in this country. That medical center presented its problem to the National Registry of Rare Chemicals, which did not find them a source of the chemical that could be exhausted, but instead found a chemist who knew a method of preparation, insuring Johns Hopkins and wounded fighting men an indefinite supply.

Recently a Canadian chemist asked the Registry for a rare chemical for his son, a biochemist with the Royal Canadian Army in Italy. The file contained a source of the item and in a short time the chemical was flown to the Italian front.

Although the Registry specializes in listing small quantities of chemicals not cataloged by regular supply houses, it has come to the aid of the War Production Board's chemical division on more than one occasion. Through its extensive contacts it has located tons of common chemicals made scarce by the war. It has worked closely, too, with the army medical corps, the chemical warfare service and the quartermaster corps, and has complied with the secrecy order of the government prohibiting laboratories from revealing supplies of rare chemicals, when that knowledge would be dangerous to the war effort.

For the Registry to fulfill its purpose, to be the greatest possible help to wartime and peacetime research, it is constantly endeavoring to increase its files listing the sources of uncommon chemicals. Furnishing this information in no way obliges the possessor of the chemical to dispose of it, although it may be assumed that the listing of a compound implies that the owner is ready to release all or part of it to another worker if suitable terms can be reached.

The Registry has received urgent requests for the chemicals listed below. If anyone has one or more, even if only in one gram quantities, please inform the Registry.

Adenosine-5-pyrophosphate
d-Arabo ascorbic acid
Normal aliphatic acids of 35-45 carbons
Arachidonic acid
2-Amino-4-methyl pyrimidine
4-Amino-3,4'-dimethyl azobenzene
2-Amino-4-hydroxy anthraquinone
Arachin
m-Anisidine
Bromacetylene
1,2-Benzofluorene
3,4-Benzofluorene
Beta amyrin
1,2,3,5-Tetrahydroxy benzene
1-Benzyl or 1-phenyl cyclopentan-1-ol
1-Benzyl or 1-phenyl cyclopentan-1,2-diol
Borobutane
Boron tricyclohexyl
Bismuth triethyl
Brassidic acid
Bhilawanol
3-Benzeneazo-p-cresol
2,4-Bisbenzene azo phenol
Cytosine
Chrysophanic acid
Cascara emodin
Cytochrome C
Coproporphyrin
Coniferyl alcohol
Cadion 2B
Carbamyl chloride

(Continued on page 42)

NEW STAFF MEMBERS

AT ILLINOIS TECH

EDWARD WAGENKNECHT, associate professor of English, came to IIT after serving on the faculty of the University of Washington for 19 years. He holds a bachelor's degree from Union Theological college, Bachelor of Philosophy and Master of Arts degrees from the University of Chicago, as well as his Doctor of Philosophy degree from the University of Washington. A well known writer, he has received special acclaim for his latest book, "Cavalcade of the English Novel," of which Ellis Roberts in the Saturday Review of Literature said, "This book is much the best history written of the English novel and novelists." His six other books also deal with literature and biography, as do his periodical writings for the Atlantic Monthly, Saturday Review of Literature, New York Times Book Review, and Coronet. He is a member of Phi Beta Kappa and the American Association of University Professors.

WILLIAM GOODMAN, professor of mechanical engineering, began his affiliation with Illinois Tech this semester. A former consulting engineer for the Trane company in La-Crosse, Wis., he is a leader in the field of air conditioning. Besides being the author of "Air Conditioning Analysis," he has designed numerous installations for air conditioning. His work for the past three years has been confidential war work. At Illinois Tech, Professor Goodman will conduct both an undergraduate and a graduate course in air conditioning. He will also conduct research and experimental investigations in this field. The present air conditioning laboratory will be expanded for the use of Goodman's students.

STANTON E. WINSTON, for 25 years a member of the faculty, is now associate director of the mechanical engineering department. He has earned degrees from the Colorado School of Mines, the University of Denver, and Armour Institute of Technology. Before coming to IIT he served as an engineer with the Empire Zinc company at Gilman, Colo., and as a teacher in the Denver high schools. He has been a member of the Midwest Power Conference since its reorganization in 1938, and its president since 1940. A member of Pi Tau Sigma and Tau Beta Pi, honorary mechanical engineering fraternities, he also belongs to the SPEE and the ASME.

HUBERT S. WALL, who has taught mathematics at Northwestern university since 1927, is lecturing on mathematics at Illinois Tech now. Nationally recognized for his research in continued fractions, he is writing a book on that subject. He holds a Doctor of Philosophy degree from the University of Wisconsin, as well as bachelor and master's degrees from Cornell college, Mt. Vernon, Ia.

GORDON B. MAINLAND, has recently been appointed assistant professor of biology. Formerly an instructor at the University of Texas, he received his doctorate from that school.

AT THE GAS INSTITUTE

GEORGE D. CREELMAN has been appointed administrative assistant to the director of the Institute of Gas Technology. In that capacity he will recruit research personnel, coordinate the institute's work in the field of patents, and oversee the library. Formerly research engineer for the Monsanto chemical company in St. Louis, Mr. Creelman, a Harvard graduate, had worked for eleven years with the M. W. Kellogg company in New York City.

LESLIE J. KANE who graduated from Armour Institute in 1929, is serving as associate engineer. He comes with fifteen years of experience in chemical research and engineering. His last position was with the Tickol corporation in Trenton, N. J., where he had worked since 1942.

WILLIAM VOLK, formerly research chemical engineer for the M. W. Kellogg company and the Kellex corporation, is assistant chemical engineer in the Gas Institute's coal and coke section. For his first assignment he is working on improved methods of utilizing southern Illinois coal. He is a 1939 graduate of New York university and has done post-graduate work at Brooklyn Polytechnic.

M. FRANK KNOY, has been appointed senior mechanical engineer in the appliance section, where he will do research and will work on the designing of gas burners and ranges, as well as on special problems of appliance manufacturers. A graduate of Texas Christian university, he was combustion engineer at the Long Beach municipal gas department for the past eight years.

LOUIS B. LEDER who was graduated from the University of Idaho in 1943, is a junior physicist on the institute's staff. He was an instructor in physics at Williams College in Massachusetts, and has done optical work for the Bell and Howell Company.

EDMUND A. WALSH, associate chemist with the institute is working under Mr. Singh on flash gasification. After graduating with a degree in chemical engineering, he worked on high temperature furnaces at the Titanium Alloy Company. Until November he was connected with DuPont in Niagara Falls, N. Y., in the development engineering department.

RUSSELL T. GRIFFITH has moved from the chemical engineering department of IIT to the same section in the Gas Institute. A graduate of Purdue in chemical engineering, he took his M.S. at IIT in 1941. He was a chemist with the Cities Service oil company for eight years.

JOHN F. SCHACKY will work on the development of the flash pulverizer. A graduate of the University of Rochester, he has been associated with the Phillips Petroleum company and the Eastman Kodak company.

DR. ERIC F. LYPE is currently doing theoretical work on sponsored appliance projects, and will act as consultant on the gasification work. He holds degrees from the Institute

(Continued on page 58)

VETERANS IN COLLEGE

By

ARLEEN WILSON

From every corner of the United States, from the British Isles, Australia, Africa, New Guinea, from every war theater of the Pacific, Illinois Tech welcomes as students the veterans of World War II.

Approximately eighty such veterans are now on the campus. They range in age from 18 to 40, and in former rank from private to captain. In the armed forces they have served as infantrymen and technicians, gunners and buglers, instructors and military police. Some were in service for years, some only a few months. But now they are not only civilians but undergraduate students — the great majority members of the freshman class.

How are these men adusting to civilian life? What is being done to see that the transition period is as smooth as possible? What aid is the former soldier, sailor, or marine receiving in his effort to re-master the techniques of study?

At Illinois Tech, planning to assist in the adjustment of the returning serviceman is already well begun in the form of a veterans' association. Started late last summer, the group now claims a membership of approximately sixty.

From the standpoint of organization, the Illinois Tech Veterans association is simple. Its officers number four. Its only membership qualification is presentation of a certificate of honorable discharge from the armed forces. Its dues are a mere fifty cents a term. There is no initiation ceremony, and the only concrete evidence of a man's membership is a printed card bearing his name.

In its implications for effective service, however, the club has tremendous possibilities. As yet it is too new for its results to be evaluated. But its aim is high—to help the returning servicemen or servicewomen to make the most of their educational opportunities; to save them from the discouragement they might face without assistance.

It began with Dr. C. A. Tibbals, dean of students. After the first World War, he saw ex-servicemen returning to school life with no provision made for their adjustment. Some of them made the grade, but others fell behind. Many of them had been gone from civilian life for months; their mode of living and their whole outlook had changed. Not less important in their adaptation to school, they had forgotten how to study.

The I. T. Vets organization has chosen as its officers (left to right) William Rivkin, treasurer; Bernard Karsh, vice-president; Sidney Mayster, president; and Jacob Kramer, secretary.

When the first handful of men discharged from World War II arrived on the Illinois Tech campus, Dean Tibbals recalled the problems of their predecessors. This time the situation would be much more complicated. A longer war in which more American boys saw action meant a more difficult assimilation. Moreover, with the new "G. I. Bill of Rights" and other government provisions for financial aid, it was certain that many more veterans would continue their education. And whereas the veterans of the first war had been gone for months, these men would return after an absence of years. How could they best be guided to utilize their opportunities?

Dean Tibbals didn't have all the answers, but he knew where to start. He gathered together a small group of the veterans, and on August 11, 1944, the future organization of I. T. Vets had its first meeting. Soon a constitution was adopted and officers elected. According to the constitution, "the object of this organization shall be to help, inform, and advise incoming veterans, to bring the mem-

bers together in a fraternal relationship which shall furnish mutual encouragement and promote esprit de corps, and to maintain contact with former students now in service."

Officers of the group, chosen soon after the opening of the term in November, are Sidney Mayster, president; Bernard Karsh, vice-president; Jacob Kramer, secretary, and William Rivkin, treasurer. Mayster is majoring in mechanical engineering, Karsh and Rivkin in electrical engineering, and Kramer in civil engineering. Dean Tibbals, who has been voted an honorary member, is counselor.

Although several of the members also belong to the American Legion, the Veterans of Foreign Wars, or the Disabled American Veterans, the I. T. Vets is purely local and is affiliated with no other veterans organization. Its function is limited to the adjustment of men while in school. It has no propaganda function nor does it espouse any political or social program.

One of the services of the club is to advise the veterans how to obtain the financial benefits due them under the government's educational program. Some of the men return to school only vaguely aware of these benefits and not knowing how to obtain them. They do not always realize that a veteran must make specific application in order to obtain this financial aid. Through the I. T. Vets these men are referred to Dean Tibbals, whose office carries through the proper procedures with the Veterans Administration so that the men receive payment.

The G. I. legislation is still new and its interpretation not yet certain in all respects. This means that the club must keep abreast of interpretations as they occur. Here again Dean Tibbals serves as a liaison. The organization also recently had the opportunity to hear Captain William B. Leggett of the Veterans Administration explain the new legislation as it applies to educational institutions. The veterans voted him in as another honorary member.

However, it is the aim of the I. T. Vets not only to keep the ex-servicemen informed of these trends but also to reach former students still in the armed forces so they can begin now to make plans for continuing their education. With the co-operation of the offices of the dean and the alumni association, the organization hopes to contact these men by means of periodic news letters. Besides information about government financial aid, the news letters will furnish the men with items of interest about Illinois Tech. Men will be invited to write and ask questions which will be answered in subsequent news letters. The I. T. Vets also plan to supply men in service with other Illinois Tech publications.

Re-acquiring the knack of studying is a problem of vital concern to many of the veteran students. This is true whether or not they had previously had college training. Several were studying at Illinois Tech or its predecessors when they were called into service. Another group was enrolled at other institutions. Although some of these were students at non-technical colleges, the majority of the veterans are now freshmen at Illinois Tech.

In many instances the course of a man's educational career has been influenced by his experience in the armed forces. Thus a former mechanic in the air force is preparing himself for aircraft designing; another assigned to radio repair work became interested in radar and is taking electrical engineering; a third decided to continue an aviation career begun in the service. Several men learned enough about radio to want to continue in this field. Signal corps and civil engineering were other assignments which so captured the imagination that the men sought further training.

Others reported simply that while in service they had come to the conclusion that further education would be highly important to them in the post-war world. One said that a physical disability sustained in service had rendered him unfit for his former work, thus necessitating a different type of training.

The renewed ambition for further-

(Continued on page 44)

Common problems and common memories have welded these veterans of World War II into the Illinois Tech Veterans association. More than sixty former members of the armed services have already joined the club.

BETTER MOUSE TRAPS

Electronic Computer for Strain Rosettes

By

W. R. MEHAFFEY

The wire type of electrical strain gages has provided a very useful tool for stress analysis. By the use of these gages engineers can check design calculations and know the actual loads to which a structure will be subjected.

In many structures the measurement of strain along one line is insufficient data since the strain may be higher in some other direction. To overcome this difficulty strain rosettes were developed. In the rectangular strain rosette two strain gages are arranged at right angles and a third gage is arranged at 45°. The observed strains along these lines are substituted into a relatively simple equation and the maximum principal strain computed. The angle of orientation of the maximum principal strain relative to one of the measured strains can also be found. Although several graphical solutions have been developed, they require nearly as much time as solving the equations.

In many applications in which a structure is subjected to a test cycle it is desirable to know the magnitude and orientation of the principal strain as the load is applied. For this type of problem the instrument to be described was developed.

This instrument is based on a diagram known as Mohr's circle for strains. This is shown in Fig. 1. It should be noted that all angles in this diagram are twice the physical angles.

From this diagram

$$\epsilon_{max} = A + B \qquad \epsilon_{min} = A - B$$

$$\text{where } A = \frac{\epsilon_1 + \epsilon_3}{2}$$

$$B = \sqrt{(\epsilon_1 - A)^2 + (\epsilon_2 - A)^2}$$

The quantity A is obtained by the circuit shown in Fig. 2. The quantities $(\epsilon_1 - A)$ and $(\epsilon_3 - A)$ are also obtained. The quantity B is obtained from a circuit consisting of a dual trade tube with both plates coupled to a common resistive load. The quantity $(\epsilon_1 - A)$ is applied to one grid and $(\epsilon_2 - A)$ shifted in phase by 90° is applied to the other grid. The voltage output is proportional to the square root of the sum of the squares of the two voltages.

The quantities A and B are then rectified and applied to electronic sum and difference meters to obtain ϵ_{max} and ϵ_{min}. The phase angle is indicated by an electronic phase angle meter consisting of a cathode ray tube with horizontal and vertical amplifiers. The quantity $(\epsilon_1 - A)$ is applied to the horizontal plates and $(\epsilon_2 - A)$ is applied to the vertical plates. A square wave is added to one of the quantities by means of an electronic mixing circuit. This results in an electronic phase angle meter with a pointer which extends outward from the center of the screen and rotates around according to the angle between the maximum principle strain and the line of ϵ_1.

The scale around the cathode ray tube is proportional to 2α in degrees but for convenience it has been calibrated in terms of α.

The instrument can be calibrated to give the maximum principal stresses by altering the strain scales and dividing the radius B by the proper factor. This set of stress scales will only apply to one type of material but a series of such scales could be provided for use with other materials.

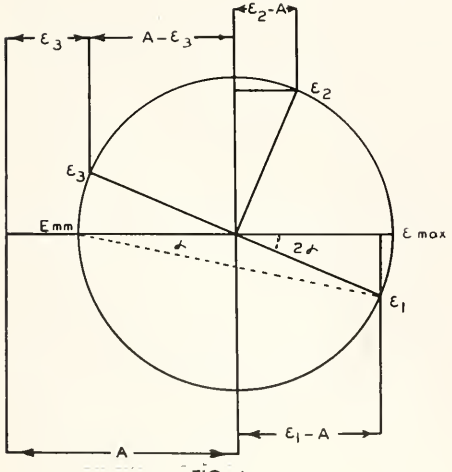


FIG. 1

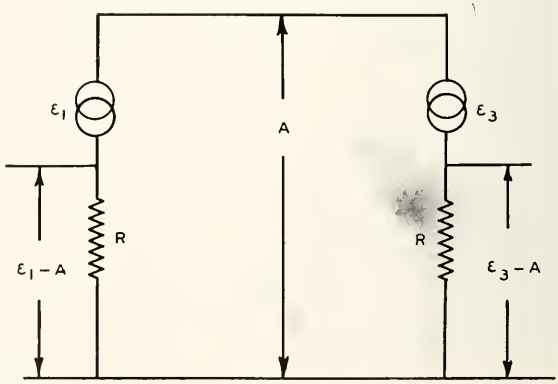


FIG. 2

THE AUTOMOTIVE LABORATORY

By

DANIEL ROESCH

Today's kaleidoscopic pattern in engineering includes epochal developments in internal combustion engines, jet propulsion, gas turbines, air transportation, and many other branches. The news flashes indicate planes with 8000 h.p. in four engines and possibilities of this power in one engine. Jet propulsion is reported with increasingly superior speeds at stratosphere altitudes. Rockets are reported using 2500 gallons of fuel per minute. Gas turbines have been greatly advanced because of aerodynamic and metallurgical researches. They have been developed to remarkable reliability and there is now a proposed 4800 h.p. gas turbine locomotive, along with many other developments. Proposed air transportation is at over 300 mph cruising. How remote or fantastic is NewYork-to-Shanghai-in-six-hours via the outer atmospheric belt?

Engineering students should have all possible awareness of current developments without sacrificing basic fundamental training. The time necessary for the former is definitely limited and must come from efficient adjustments of the latter. Some of these adjustments which have been made for automotive studies are indicated below. Others are in process, with the recognition of further changes of equipment and additional space after building restrictions are removed.

Present activities in this laboratory include civilian and Navy V-12 engineering college courses, two series of experiments for ESMWT courses, and some experimental work in connection with specific war problems.

Laboratory Exercises

The following experiments furnish fundamental training in laboratory technique. They are co-ordinated with previous classroom work in associated mechanical engineering subjects. They furnish training for the student in tests on commercial engines and accessory equipment, taking into account the viewpoint of builder or user, and the theoretical analysis of design and performance. Full details of individual tests are, of course, beyond the scope of this article.

The laboratory is provided with three electric cradle dynamometers of 20, 100, and 250 B h.p. capacity, for automotive engine testing and also one Mid-West Engineering Company Dynamatic corporation induction cradle dynamometer of 200 h.p. capacity for

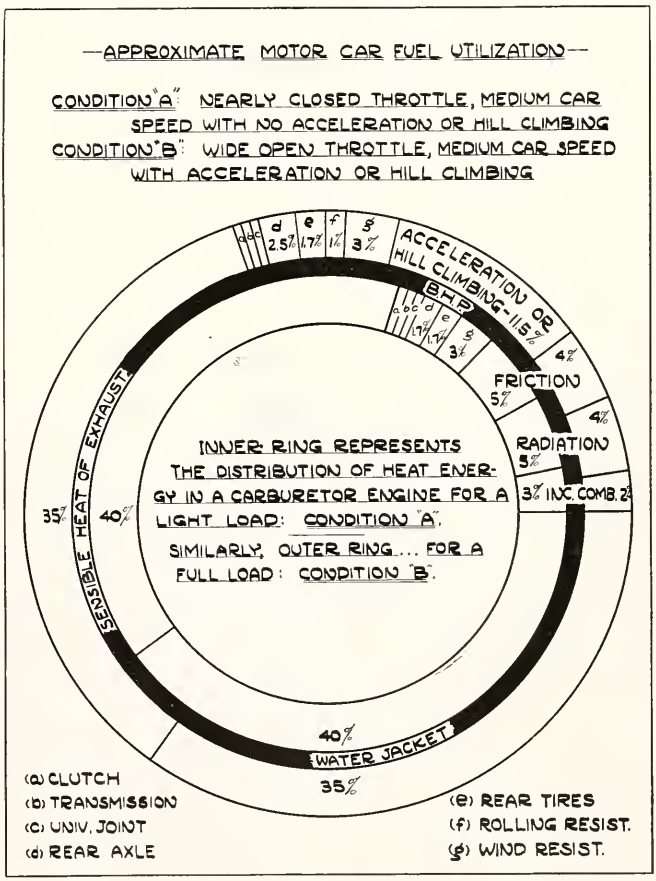


Fig. 1. Fuel Energy Distribution for an Automobile at Two Operating Conditions. Students' Projects

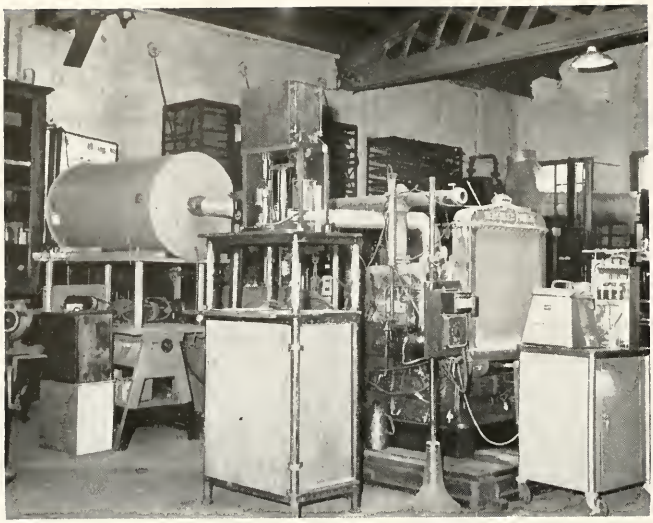


Fig. 2. Hercules Diesel Engine and 200 HP Electric Cradle Dynamometer. Air meter at left center. Fuel weighing machine at center. Ellison exhaust analyses and Orsatomat at center right

speeds up to 5000 r.p.m. This latter is equipped with an electronic constant speed control which for altitude power studies is usually adjusted to 1000, 2000 and 3000 r.p.m. This is a versatile full-speed-range control and a most valuable accessory for making constant speed runs. It is of Dynamatic corporation design and construction. This type induction dynamometer is widely used in aircraft test-cell work up to 4000 horsepower and more, and for special work up to very high (restricted) speeds.

The induction dynamometer is fitted with a Chrysler Royal engine, while the 100 h.p. electric cradle dynamometer is fitted with a Buda special engine with various clearance heads. These units have special equipment, which for the analytical studies given regularly to mechanical undergraduates, provide for the following tests:

Variable Intake Control for Altitude Power Studies

Variable Mixture Ratio Control for "Fish Hook Curves"

Variable Speed at Wide Throttle for Power, Friction, and Mechanical Efficiency

Variable Spark Advance by a Special Double Insulated Spark Fanning-out Device and Ignition Breaker Points on Crank Shaft.

Accessory equipment includes air meters of the orifice and nozzle types, representatives types of speed-measuring devices of chrometric, Sun Tach-Meter, Strobotac, tachoscope, centrifugal, electrical and Frahm Reed types; individual and collective gas-sampling types from each cylinder; Leeds & Northrup multiple potentiometer for temperatures of mixture before and after jet, exhausts, jacket water, etc.; Powers thermostats for jacket-water temperature control and suitable means for obtaining jacket water losses; Ellison and Hayes Orsat equipment, and Orsatomats, Cambridge analyzer and Moto-Vitas.

The following descriptions and accompanying views illustrate some of the major, accessory, and supplementary equipment used for regular students' testing work. Some descriptions are for specialized tests and for special exercises used for shorter witness experiments, demonstrations and exhibitions. Other agencies of instruction actively used are selected publications from technical literature and from many industrial firms. These bring to the student's attention up-to-the-minute information on late developments. Recent views taken in the laboratory are shown and indicate further the nature of studies available. A brief description is given of various tests and appliances.

One of the most important engineering analyses of the performance of an engine is shown by the heat balance test. The completion of this experiment requires practice with a considerable number of testing appliances and one or two preliminary laboratory periods. Preparation of the report gives experience with many engineering computations previously dealt with only from textbooks. The customary indicated h.p. heat equivalent is obtained by indicator cards and the brake h.p. by suitable loading means. The jacket water loss is directly measured by the quantity of water flowing through the jackets and the resultant temperature rise. For measuring the sensible heat in the exhaust, a special counter-flow heat exchanger has been made from finned tubing, since commercial heat exchangers of suitable

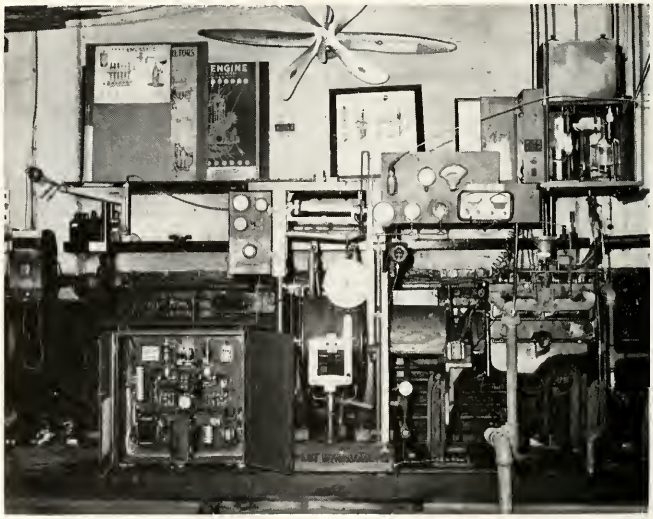


Fig. 3. Chrysler Royal Engine and 200 HP Midwest Dynamatic Induction Dynamometer with Electronic Constant Speed Control (lower left)

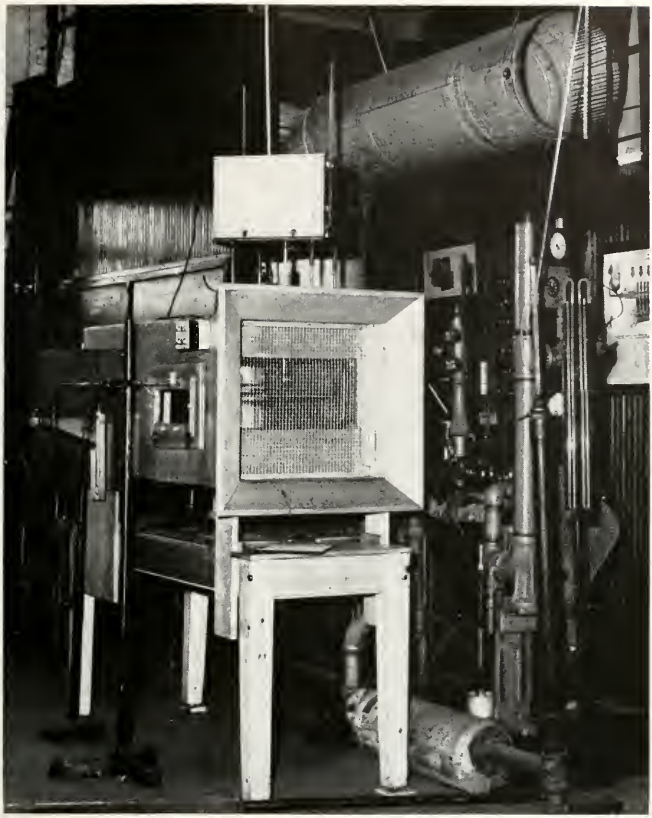


Fig. 4. Dodge Engine Driving a Special High Speed New York Blower. A valuable utility unit. Model wind tunnel is in center and shown also in Fig. 5

capacity could not be found to fit into the limited space. This exchanger reduces the exhaust temperatures to approximately room temperatures. The unburned gases are determined by exhaust analysis. This leaves the radiation loss by difference.

Less comprehensive heat distribution tests are conducted with other engines to illustrate various engine types and different testing methods and testing appliances. The simplest of these tests is the commercial type of fuel economy and maximum power test. A Diesel and a carburetor engine test of this kind are regularly given, with loading and practice with electrical load in each case.

Cradle Dynamometer Testing Buda Special Automotive Engine

This is a Buda special 4-cylinder 3" x 4½" bore and stroke engine, having various compression heads. The customary head used is for 145 lb. per sq. in. compression which permits service demonstration of knocking characteristics and octane values of automotive gasolines up to about 80 octane number. This engine is fitted for a number of routine and special tests. The mixture ratio may be varied from extremely lean to extremely rich. The engine is also used for the conventional variable-speed wide-open-throttle test with friction horsepower and mechanical efficiency by the dynamometer method. 100 octane fuel permits a spark advance (90 degrees early and more) which permits wide open throttle and zero brake horsepower output.

This engine is fitted with individual exhaust sampling tubes located close to the exhaust valves, permitting a study of mixture distribution. Thermocouples are generously distributed around the engine. The two thermocouples on either side of the carburetor fuel jet give a fine test for temperature drop across the jet and illustrate the cause of carburetor icing. Experimental data show from 20 degree F to 45 degree F temperature drop and illustrate further how this changes with the mixture ratio.

Hercules Diesel Engine

A Hercules DRXB 4⅜" x 5½" 6 cylinder Diesel automotive type engine is flexibly connected by means of a double universal joint to the 200 h.p. electric cradle dynamometer. Air-fuel ratios are determined directly by fuel and air intake measurements and indirectly from the exhaust analyses. A Wheelco ten-point indicating potentiometer measures individual exhaust temperatures for load balance between cylinders, also temperatures of oil

Fig. 5. Model Wind Tunnel side view showing 18 inch duct to intake of New York Blower, Ellison Draft Gage for tunnel air velocities and window for model inspection. The box on top of the tunnel is a "NEWS" lift and drag balance designed with a hydraulic-mechanical network

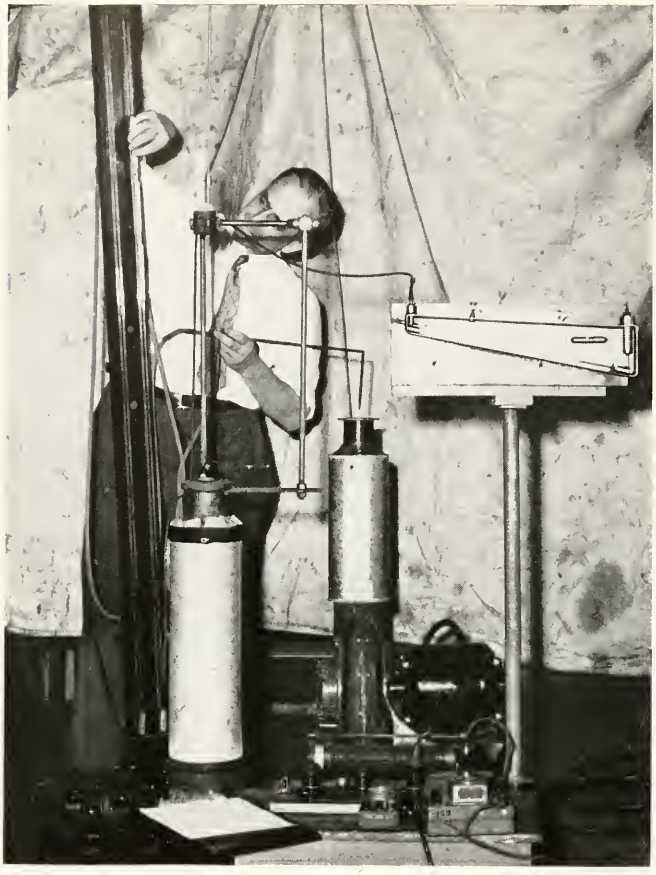


Fig. 6. Micro Wind Tunnels No. 1 and 2. (Center rear.) For drag coefficients only at present

throw-off from one crank pin and oil in sump. The Bosch fuel pump permits tests at variable injection advance. Service cranking is by a 24-volt battery without compression relief. Besides standard shunts in the starting circuit, several of the battery jumpers have been fitted with terminals for millivoltmeter connections and used to demonstrate a practical improvised shunt, subject, of course, to temperature effects. (One millivolt corresponds to 11.0 amperes; 50 millivolts drop is not unusual for starting.) See Fig. 2 for set-up.

Chrysler Royal and Midwest Dynamatic Induction Dynamometer

This unit, which may be seen in Fig. 3 in broadside view, is on a welded steel bed-plate. The engine is at the right-center with the Illinois Institute of Technology fuel-weighing machine directly above it. The cradle dynamometer. A small A.C. generator is at torque measurements are in the center. The small panel to the left of the scales is for external D.C. hand control of loads. The automatic electronic constant-speed control cabinet and panel is mounted on the bed-plate, directly to the left of the dynamometer. A small A.C. generator is at the rear and not shown. This control operates on 3-phase A.C. and has a sensitive rheostat hand adjustment for controlling to any constant speed as selected between 500 and 4000 r.p.m. It is of Dynamatic corporation design and construction. Actual speeds are indicated by an Elgin chronometric tachometer, a Sun electric two-range tachometer, and by Hasler-Tel or other hand counters. The gage board has necessary pressure and temperature indicators to control the operating conditions and four intake manifold vacuum gages, one of which is on the conventional absolute pressure scale as used in aircraft engine practice. (The propellors of various sizes are shown on the back wall.) A double - insulated spark - fanning - out device is attached to the front engine shaft (not shown in photo). The water jacket is controlled by a Powers regulator and the system is designed to permit the determination of jacket water losses.

International Harvester Diesel Engine

An International Diesel model UD-14 is mounted on a Rockwood base and used to demonstrate constructional and operational features of this widely used engine. An animated 1200-ft. sound film, supplied by the International Harvester Co., gives an unusual educational presentation of this engine (as well as of Diesels in general) and may well serve as a pattern in visual education. The engine is sometimes belted to a twin D.C. generator for laboratory electric service. Practice is then afforded in paralleling D.C. generators, as well as the study of engine operation, maintenance, and performance.

Fairbanks Morse Engines

Besides the Fairbanks Morse single cylinder gas engine standardized heat balance tests and other studies, there is in the laboratory a late model Fairbanks Morse model 36-A single-cylinder Diesel engine directly connected to a Fairbanks Morse generator. This 10-hp. unit has its own loading by a bank of lamps or may be used for emergency electric service in the laboratory. Provision has been made for determining the overall efficiency jacket water and exhaust loss, Bosch fuel injection pump and governor characteristics, as well as practice in starting and handling this engine. This unit set-up is primarily for overall efficiency tests to parallel a similar test of a gasoline-electric test set. The Fairbanks Morse single-cylinder gas engine, mentioned at the beginning of this paragraph, is one of few older engines in the laboratory and, while now over 40 years old, has advisedly been kept in regular service for specific experiments. The following excerpt from the "Discussion" in a student's report (May 1944) is interesting: "More can be learned by studying the construction and operation of these 'antiques,' with their wide-open construction and simple operation, than could be learned from a streamlined modern engine." It becomes apparent from a studied selection of new equipment and methods during routine rehabilitation, that occasionally older equipment and methods may become a part of the best composite program.

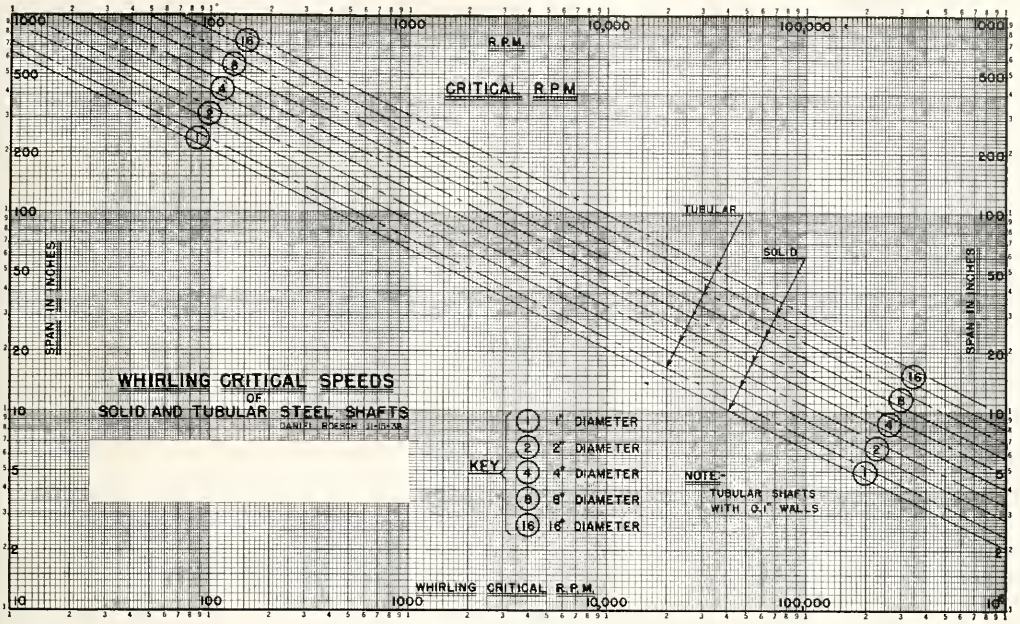


Fig. 7. Whirling Critical Speed Chart

Dodge Engine and New York Blower

A Dodge automobile engine is directly connected to a model ME New York blower and functions as a laboratory test set and a versatile utility unit. When built a few years ago, it was used for a limited practice on carburetor adjustments with correlative exhaust analyses and for air velocity traverses. The engine unit and the blower discharge duct are shown on the right side of Fig. 4 with the recently built model wind tunnel in the center of the view. The outlet duct has a 34-unit pitot manifolded for the center of areas of each 20 sq. in. increment. This multiple pitot unit is center-mounted to swivel at any angle of the protractor index. The maximum air speeds have been over 100 miles per hour. This unit has since been used to provide the air for the model wind tunnel. (See Figs. 4 and 5.)

Mechanics, electrical, carburetion and lubrication each have become an important phase of internal combustion engine studies, but certain abridgements are necessary to bring the course content within limits of time available. In many cases an insight into major portions of these four items is regularly injected into some of the experiments mentioned above. It has appeared advisable, however, always to devote one period tc valve gears, and their functioning. A portion of the time of other laboratory periods also includes work on pistons and crank mechanisms. These conditions apply also to the other three classifications.

A copper-beryllium torsional pen-

(Continued on page 48)

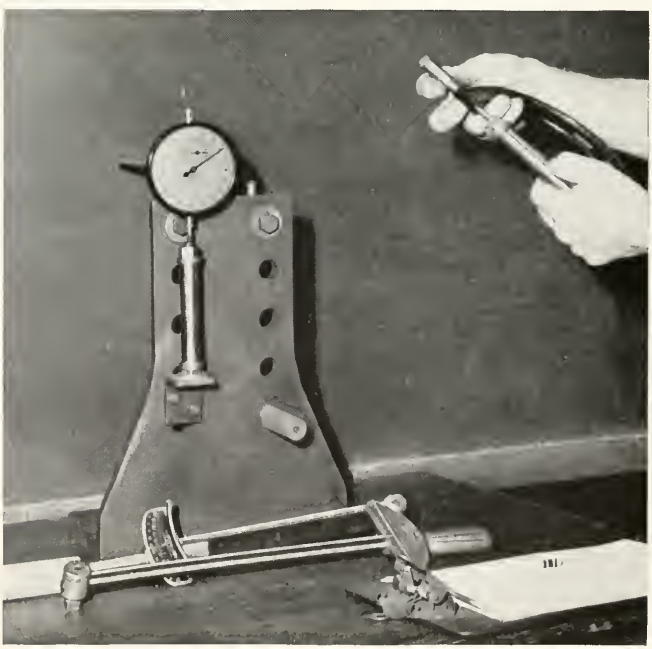


Fig. 8. Torque Wrenches (2), gaging stand and hand micrometer

FROM YEAR TO YEAR

A RECORD OF OUR ALUMNI AROUND THE WORLD

MEN OF THE MONTH

A figure, well known to the alumni, is Claude A. Knuepfer, who graduated from Armour Institute in 1915 with a degree in civil engineering. He has distinguished himself by working to the top in most of the activities that he undertakes. He graduated from Lane Technical high school and from Armour Institute of Technology as president of the senior class. Always interested in extra-curricular activities while at Armour, he was business manager of the Cycle, editor of the Armour Engineer, member of the Radical X, member of the student branch of the A.S.C.E., and in charge of instruments of the civil engineering department. He helped pick out the present camp site of the civil engineering surveying camp at Trout Lake. Under the supervision of Prof. John C. Penn and with three or four other students, the buildings were erected without any outside help. Knuepfer played varsity basketball and is a member of Phi Kappa Sigma fraternity and of the Pi Delta Epsilon, honorary collegiate journalistic fraternity.

His undergraduate activities and interest have continued with his participation in alumni activities. In the Armour Alumni association he served on the board of managers, acted as vice-president, and is now the president of that organization which is being liquidated. Knuepfer was elected to the board of the Illinois Tech Alumni association in 1943 as the representative to the board of trustees of the Illinois Institute of Technology and the Armour Research Foundation.

Claude Knuepfer

His term of office is for three years, and he has aided the success of the merger of the two alumni groups to a considerable extent by his quiet but purposeful suggestions.

Upon graduation Knuepfer served as superintendent and secretary of the Automatic Screw Machine Products company from 1915 to 1917 and from 1919 to 1922. In the intervening period he served as a first lieutenant of the engineering corps. During the 27 months that he served, 13 months were spent with the American Expeditionary Forces in France; he took an active part in the offensives at Meuse-Argonne and at St. Mihiel.

In May of 1922 he left the Automatic Screw Machine Products company and started the General Engineering works as president and general manager. Also associated with him is W. J. Tarrant of the class of 1923. His plant, located at 4701 West Division street, Chicago, is the product of years of hard work and effort. Starting with a small shop and doing a variety of the work necessary to insure the success of the company, Knuepfer can show his plant with real pride and a sense of accomplishment. Manufacturing screw machine products as well as other jobbing manufacturing, the plant turns out an amazing volume of business. During the past few years the work has been completely war production, and considerably more space was added to take care of increased production. Space was saved for a small research shop where some of the new ideas that are always arising from the work on hand might be tried out. At the present there is not time for further work along this line. Doing custom jobs almost entirely, there is hope of adding a line of their own after the critical war period has passed.

Knuepfer was one of the original founders of the National Screw Machine Products association. He is a director and a member of the following committees: manufacturing standards, standard terms and conditions of sales, and surplus machinery disposal. This organization and the Illinois Manufacturers association are two in which he is particularly interested.

(Continued on page 44)

For this issue one of the men of the month is a woman. Like many other exclusively masculine institutions, this column now surrenders to sheer feminine ability. A member of the gentler sex has crashed this formidable barrier —Dorothy Thompson, columnist, commentator, writer and internationally known lady of distinguished achievement. And why not—literature, sculpture and architecture have long since capitulated to women. At present, activities such as operating lathes, servicing trains, assembling radio equipment and drawing blueprints are being performed expertly by women and in some instances much better than by men. Engineers and alumni of distinction, move over and be gallant about it because this is only the beginning of alumnae appearing in this column.

Dorothy Thompson

Dorothy Thompson received her last two years of high school training at Lewis academy and her first two years of college work in the Institute culminating in the Lewis title then offered, "Associate in Arts." Dorothy majored in English at Syracuse university where she was graduated in 1914, thus completing her formal college education. She intended to be a teacher, but instead became a leader in the women's suffrage movement, soapboxing in upper New York. Classmates at Lewis remember Dorothy as an alert young woman with a keen intellect and as an honor student, participating in collegiate activities she liked with intense interest and with an inherent driving force the like of which is seldom seen in undergraduate students. Slender and wiry, she went in for athletics, playing guard on the 1911 Lewis women's basketball team. This is the famous team which modestly boasted that it was never defeated. The scores of the four games scheduled were always 0 to 0. At the last minute the opponents gracefully withdrew, frightened by the reputation of the undefeated Lewis team. They stalked the college campuses like a five-woman army of Amazons. Under present rules they would have won all games by default.

Her marked interest in English history, political economy and foreign languages forecast her future celebrated career. As a member of the debating team she unhesitatingly defended her side of an argument with vigor, all of which is reminiscent of her masterful presentation of a political stump speech broadcast and rebroadcast during the recent presidential campaign. No matter what one's political beliefs are one cannot help but admire the skill with which she landed each telling verbal blow in her outstanding political talk in support of Roosevelt. Classmates recall that in an argument with the late Dean Edwin H. Lewis she frequently and apparently unknowingly moved gradually up the aisle toward Doctor Lewis convincing him that she was right to his obvious delight. She took part in a debate on the question of whether the English parliamentary system is superior to the American congressional system—a live subject even today. Doctor Lewis picked her as one of his students who would go to the top.

College dramatics attracted Dorothy. Her name appears on the *Dramatis Personae* as "Resolute Story," aunt to Captain Standish, in a four-act costume play, "A Rose o' Plymouth Town." Who knows but this early training, plus natural talent, may have been the precursor of her ability to become the center of attention whenever she appeared in groups of people either large or small—in short, a master of dramatics, achieving the reputation as the "most interesting and dramatic personality among the columnists."

Dorothy went in for other extra-curricular activities. She was a member of the Collegiate Girls club and president of Stephanotis society (1911). She leaned toward the more serious side and had no time for the obvious clowning and antics of those coeds favoring a good time in lieu of high marks. Men at Lewis remember Dorothy as an attractive young lady with a brilliant intellect, but with no fondness for small talk. Lewis men essentially agree with the lad from Syracuse who is recorded as saying "She knew too much: a fellow felt inferior." She had a penchant for stalling off romantic approaches with arguments on public questions, and according to this lad, "It is unnerving to take a girl to a dance and have her discuss the tariff while strolling on a moonlit balcony."

Dorothy Thompson was born in Lancaster, New York, the daughter of Peter Thompson, a Methodist minister an immigrant from England. When she was seven her mother died. At fourteen she went to live with an aunt in Chicago. Before enrolling in Lewis academy, she attended Gowanda, New York, high school and Oak Park high school.

After her graduation from college in 1914, she did organization work for woman suffrage. She spent 1917 and 1918 as a copywriter in a New York advertising agency. In 1919 she did publicity for a social service project in Cincinnati. With about $150 in her purse, she sailed for Europe in 1920, with no particular destination in mind but with a strong desire to study foreign conditions. On the liner she met some Zionists bound for a conference in London, and persuaded the International News to let her cover the conference. This was the beginning of her journalistic career.

The reader might well refer to WHO'S WHO for additional information and also to the numerous magazine articles about her, as for example, those in Scribner's, Harper's Bazaar, The Nation, Ken Magazine, The New Yorker, The Saturday Evening Post, Time, Look Magazine and many others.

Although the aforementioned articles do not agree in certain minor details, they do agree that she likes hard work and likes life, socially and in a larger sense, that her belief in civil liberties is genuine, that she dislikes fascism, that she is prodigiously informed and self-confident, and that she has tremendous energy and insatiable curiosity. In them one will find accounts of many other exploits.

To cite a few: John Gunther called her "an amiable and blue-eyed tornado" which tore through Central Europe with a freshness that won prime ministers and rival correspondents. Don Wharton wrote "Nothing prosaic ever—happened to her." As for example, she arrived in Ireland the week Archbishop Mannix was kidnapped; in Milan the day the metal workers went on a strike, and in Vienna the morning of the first Karlist Putsch. Disguised as a Red Cross nurse, she slipped through a double cordon and scooped the world on an interview with Karl and the Empress. She rushed to trains without bags, crossed boundaries without passports and covered a Polish revolution in an evening dress and satin slippers. Dorothy got wise to the latter by overhearing the

(Continued on page 46)

WITH OUR ALUMNI
IN THE SERVICE

1917

BOLTE, MAJOR GENERAL CHARLES L., CH.E., is now commander of the veteran 34th infantry division. He served in France with the Fourth infantry division in the first world war. He was wounded in France but remained in the field and later served with the Army of Occupation. From 1922 to 1926 General Bolte was aid to General J. L. Hines, then chief of staff. He is a graduate of the infantry school, the command and general staff school and the army war college. His most recent duties include serving as assistant chief of staff, G-3 Fourth Corps, special observer in London, chief of staff of the initial American forces in England, assistant commander 91st infantry division, and commanding general of the 69th infantry division. His family resides in Richmond, Virginia.

1927

DAVIDSON, D. B., F.P.E., a lieutenant in the U.S.N.R., wrote this interesting letter to Professor John Schommer:

"Dear John:

"It was mighty fine to get a letter from you, believe me! Word from folks at home is about the most welcome thing in the world to us fellows out here. Brother Jim has been most faithful in sending me information about school and items of general interest from Chicago—and though often several months on the way—I do receive the 'Technometer.' You people are doing a mighty fine job at Illinois Tech. This work is pretty interesting, John. I have spent the last year as fire marshal and ass't. First Lieutenant on the world's most powerful battlewagon. She is a beauty, and some day perchance, I'll have the pleasure of showing you around the old tub. Meanwhile, I can say it's sure going to be 'great' to get back home to old familiar sights and friends! Thanks again for your letter, John! Please remember me to all the gang back there."

As Ever,
(Signed) LT. ("DERE") DAVIDSON, U.S.N.R.
U.S.S. New Jersey
c/o Fleet Post Office
San Francisco, California
Pacific Combat Zone

1933

The following news release was received by the Alumni office and reads as follows:

"The members of the Chemical Warfare School 21st Toxic Gas Handler's Course have completed their training September 30th.

"Among the officers graduating was Roy W. CARLSTROM, F.P.E., whose home is at 6207 N. Artesian avenue, Chicago. Before entering the Navy he was a fire protection engineer and special agent for the American Insurance Company."

1934

The following news release was received by the Alumni office:

"Engineers for the most powerful Naval Armada in history—the U. S. Navy's proud fleets—are trained in one of the 17 Service Schools at the Naval Training Center, Great Lakes, Illinois. One of the officers who has an important part in training these engineers is LT. BERNARD L. BLOCK, E.E., formerly an electrical engineer with the Public Service Company of Northern Illinois.

"During 'boot' training, men are given a series of aptitude examinations, and those selected for advanced training in the basic engineering school are given an intensive eight-weeks course after they have completed 'boot' training.

"Well equipped shops and laboratories are available, and visual and other synthetic training aids are employed to give the men the most complete and modern instruction.

"Lt. Block was engaged in the design, construction, and operation of electric power plants for the Public Service Company before joining the Navy in September of 1942 as a Lieutenant, junior grade. He was promoted to Lieutenant, senior grade, on January 1, 1944.

"Lt. Block was sent on a shakedown cruise aboard a destroyer for three months in the Atlantic theater."

1938

FRISCH, 2ND LT. HARRY M., A.S., son of Mr. and Mrs. Joseph Frish, 5542 South Racine avenue, Chicago, is now on duty as a chemist and assistant laboratory section chief in a chemical company at the island base of New Caledonia, South Pacific. Lt. Frisch is a graduate of Illinois Tech and is a member of the Delta Upsilon fraternity. Prior to entering the Army, he was employed as chemist with Victor Mfg. & Gasket Co., Chicago. He entered the army in November, 1940, at Fort Sheridan. After spending nearly three years as an enlisted man, Lt. Frish was sent to the Chemical Warfare Service school, Edgewood Arsenal, Maryland and was commissioned. He has been overseas since January, 1944. His sister, Lt. R. E. Frish, is a member of the army nurses corps.

Professor Schommer scores again. This letter was received from E. F. SIPP, M.E., a lieutenant (j.g.) in the U.S.N.R. and reads as follows:

"Dear Professor Schommer:

"Thank you kindly for the sweet breeze of June, 1944. It was delayed because of the address to my previous ship. Thought you would like to know of my new address and how things are going.

"You really summed up the news at home in fine fashion. Some of your witty expressions hit the funny bone and your invitation to look you up is a date.

"Have recently become chief engineer after serving aboard four months as assistant engineer officer. A ship is a city in itself. It serves as a home, a restaurant, recreation center, and last but most important as a floating weapon against the enemy.

"Best regards to Armour and Illinois.

Sincerely,
(Signed) LT. (J.G.) E. F. SIPP, U.S.N.R.
U.S.S Electra
c/o Fleet Post Office
San Francisco, California."

1940

DEMENT, C. W., F.P.E., a Lieutenant in the U.S.N.R., wrote this interesting letter to Sonny Weissman:

"Dear Sonny:

"I think that Mankus will soon have to give up his title of greater out here. He is one fellow that I haven't seen in fact. In the past 3 days I have met Herb Sher, Jim (Dixie) Duncan, and John Butkus and my new roommate is Claire Dunbar. Joe Janicek is around close, too, but I haven't had a chance to look him up yet. John, Jim and Claire and I, of course, spent most of today together and had a good Bull session with a capital BULL. Your ears should be blistered tonight. I really enjoy seeing the gang tho Sonny and since it looks like I'll be here for a while yet, be sure and get my new address in the next Circular Letter, will you? The fellows coming this way will be able to look me up.

"This is pretty good duty here, Sonny. We have a nice office and a good crew and are quartered about a block from work. We live in Bachelor Officers' Quarters with 4 men to a room. The rooms are plenty big for 4 and are kept quite clean and comfortable. There are plenty of recreational facilities close by, including bowling alleys, swimming, tennis courts, and of course an officers' club. In fact, we played 6 sets of tennis today and I am almost a physical wreck tonight. (No cracks). They also have several movies in the vicinity, all free.

"How's that bunch at Sigma Alpha getting along? Did that talk we had with them do any good? They seemed like a nice bunch, you really shouldn't ride them so hard. It's good for them though, I guess.

"Had a letter from Collier a week ago. He was on a ship en route from Rio de Janeiro when he wrote. Didn't say where he was headed of course. Have you heard from Dick Van? I'd like to know if he is still a civilian.

"My brother George sent me three rolls of Kodacolor film recently so I have been taking a few pictures around the island to exhibit when I get back. I took a bunch in to Kodak Hawaii in Honolulu not long ago but found out they were out of photographic paper so couldn't get them printed. I'll have to try again soon as I am anxious to see them. That's about it, Sonny. Give my regards to John and the rest, including Virginia and little Weissman. See you in a year or so.

Sincerely,
(Signed) LT. C. W. DEMENT, U.S.N.R.
Fleet Weather Central Box 182
Navy Number 128
c/o Fleet Post Office
San Francisco, California."

P. S. I gave my stenographer H—— for the lousy typing above but I'm afraid it didn't help much.

1941

The following letter was received from BUD MURRAY, CIV.E., to Sonny Weissman:

"Hiya Sonny:

"Just received your August 23rd endeavor, so intend to keep my promise so here it is.

"Our flat top—the great N. B. will soon be a year old. Oct. 14, last year we took her over, and there are quite a few of us left who put her on the road to 'fame.' But she's still going strong and so are we.

"Glad to hear you got away for a few days vacation. Can't seem to decide whether the rest would do you good or harm, but guess I'd better let you worry about that!

"How's Dean Tibbals doing? Next time you see him tell him I said hello and wish him lots of health.

"Yes, and you'll have to drop into the Mech. office for me. Give my regards to Mr. Yellott and Mr. Winston.

"There was a time these south sea Islands gave us new lads a thrill. But not any more, they are just bits of mud rising above the old Pacific and there isn't much to them.

"The war does look good, doesn't it, Sonny? We all feel pretty good about the whole thing and now we have a great goal to shoot for, of course we have known about this goal for a long time, but it's different when you get to see the whites of their eyes.

"How's good old John Schommer doing? His note to us not too long ago was just like him—busy as h—— but enough time to say hello to us all. Well, we aren't forgetting such things and will be back some day to show it.

"Tell Miss Steele we could sure use her wonderful collection of books out here. This is a favorite pastime of ours and some of the lads really go through our library.

"When you are talking to Helen Nitchen give her my best. Tell her to drop me a line when her arm heals.

"Well, Sonny, here's wishing you luck in all your work—and keep us posted on the gang.

"My address in your Aug. 23rd issue was and is correct."

As Ever,
(Signed) Lt. (j.g.) Bud Murray
U.S.S. Natoma Bay CVE 62
c/o Fleet Post Office
San Francisco, California.

Sonny Weissman is again the recipient of this following interesting letter:

"Dear Sonny:

"Just got your letter of the 23rd of August. It takes a while for the mail to get out here. Guess haven't told you the mighty 'M' has changed oceans. Things were too quiet over in the Atlantic, so we moved over to finish off this Pacific war. Can't tell you where we are, but I think you can make a pretty good guess.

"I saw Hack Barth a couple of months ago when I was in Norfolk. Hack looks 4.0—and a two striper. I haven't run into anybody out here yet, but this Pacific is plenty big.

"No kicks about destroyer life. Plenty of food and regular sack drill.

"I heard from Johnny Range the other day. He's up in Bremerton, Washington—he's got some soft shore job. It's alright if you can get it.

"Say hello to all my old chums around school. So long for now."

(Signed) Ens. Robt. Johnson, U.S.N.R.
U.S.S. Mansfield DD 728
c/o Fleet Post Office
San Francisco, California

The following letter was received from E. E. Dailey, Civ.E., and reads as follows:

"Sonny:

"Sure get a kick out of your news letter. Tho' there are a lot of names I don't recognize, there are a lot that I do, and it's nice to hear of them all. My folks have been forwarding the letter to me from home so keep sending 'em to that address, will you? What ever happened to Barech, Saigh, Goety, etc.? Last news I had of them was from Fred Ehlert whom I saw in Pearl last October. He was with 99th Nav. Const. Btn., F.P.O., Frisco —I finished the course in Miami and now at Radar School in Hollywood. Good school but Physical training is knocking me out. Good fo. me tho'. Phyl sends her best. . . ."

(Signed) Lt. (j.g.) E. E. Dailey
U.S.N.T.S. Radar
Hollywood Beach, Florida

Sonny Weissman scores again. This letter is from W. F. Bauch, a lieutenant in the U.S.M.C.

"Lear Sonny:

"Hello from the South Pacific. I want to scratch out a few lines to let you know how things are and also so that you can change my address on your mailing list. As the saying goes, a lot of water has passed over the dam since I last wrote.

"We left Camp Le Jeune July 15, and traveled across country on troop trains. The trip was okay with plenty of sightseeing and a goodly supply of liquor. Our destination was Camp Linda Vista, San Diego. Our stay in Dago was very short, only ten days to be exact. Our first task there was to unload 33 box cars and 78 flat cans. No sooner was that done than we had to get all that gear coated and marked so that it would be put aboard ship. In order to meet the deadline we had to mark night and day, but we finally made it.

"With all the rush, though, I did manage to squeeze in two days in Los Angeles. A friend and I went there and in the short time allotted we did our best to paint the town red. Let me tell you, that is the best liberty town going. It beats Washington all to h—. We also took a look at Hollywood where the babes were plenty good to look at, but very unfriendly, if you get what I mean. The corner of Hollywood and Vine isn't much to look at. It reminded me of 63rd and Halsted minus the elevated.

"At any rate, after ten days in Dago we shoved off and had a very pleasant voyage. We had about 1200 troops aboard which was small enough to all, plenty of room on deck, etc. I found myself an army cot on which I slept almost every night. The travelogues of the South Seas are understatements when it comes to describing the tropical nights. They are really beautiful.

"The highlights of the trip was our crossing of the equator when us 'Pollywogs' were converted into 'Shellbacks.' The initiation consisted of being soaked with a fine hose, a grotesque haircut, being painted all over with a mixture of creosote and fish oil, and plenty of paddling. All in all it was a big day and a good time was had by all.

"We finally landed here after 15 days at sea on what is called 'the paradise of the South Pacific.' It was a very famous battleground during the earlier stages of the war. Now all that remain are shattered coconut trees and a few duds lying around.

"We have a pretty good camp set up amid a coconut grove. We have all the necessities and a few of the luxuries but about 90% of the food is canned. The biggest drawback is that the beer situation is very bad. My first and last brew since we have been here was had when I visited some friends down the road who had just returned from Guam. We have an officers' club within the regiment but as yet it isn't in operation.

"That's about the scoop on events here, 'Roundy,' now how about things in the city? I presume that the Institute is doing a rushing business, and you are in the midst of things. Please extend my best wishes to Virginia and Nancy who must be getting to be a big girl by now. When you get time, Sonny, be sure to drop a line or two my way and don't forget to change my address on your mailing list."

(Signed) Your friend,
Lt. W. F. Bauch
Pioneer Co. 29th Marines (Reinf.)
c/o Fleet Post Office
San Francisco, California.

An interesting letter was received from Ensign Harold E. Hering, M.E., and reads as follows:

"Dear Sir:

"Just received the Oct. issue of the 'Illinois Tech Engineer and 'Alumnus' and felt like dropping a line to the Alumni office. Noted the names of some fellow students amongst the letters and addresses and sure was glad to hear about them. They sure are scattered far and wide.

"I have been in Washington about one year and had been rooming with another Illinois Tech Alumnus of June, 1941. He was LT. ARTHUR W. STRUTZ, of 2726 W. 24th St., Chicago, Illinois. It is with a note of sadness that I have to report his death while he was on leave at home the latter part of June, 1944. It was not caused by anything received while in the armed services, but was reported as an intestinal obstruction. His death was sudden and was a shock to me as he had been in perfect health when he left for home from Washington, D. C. He had obtained his education received at Illinois Tech by night schoool attendance for a good many years to earn his B.S. degree in M.E. I knew him while he lived in Chicago and was very glad to have been able to be a roommate of his while in Washington. I thought a great deal of him and respected him.

"Well, I guess that is all I have to say for now except that I wish the school continued success and hope that its expansion continues to make it one of the greatest Engineering Schools in the States".

(Signed) Yours Sincerely,
Ens. Harold Hering
3415-38th St., N.W.
Washington 16, D. C.

1942

Lasco, Lt. Henry A., E.E., a pilot of a B-24 (Liberator) bomber has been on many missions over enemy territory. He became a prisoner of war when his plane was shot down bombing Ploesti. He was reported missing since August 1, and since has been freed and came home for a furlough on Oct. 19. His home is at 1625 North Mango avenue, Chicago.

The Alumni office has received an interesting letter from Ernest F. Lilek, A.S., a lieutenant in the U.S.N.R.

"Dear Fellow Alumni:

"I've been receiving the Technometer now for the past two years and have enjoyed it very much. It has been following me around now since April, 1943.

"I served eighteen months in the Aleutians at various stations, the last being the well known island of Attu, that was retaken from the Japanese in May, 1943. The stay up north was a pleasant one even with all its shortages.

"I'm an aerologist now, that is, since I've been in the Navy and find the work quite interesting. Many is the time a good 'sweat' was the result of a day's work, but somehow I survived and still find myself alive, well, and kicking.

"The Technometer has been enjoyed very much and reading about the old school brings back many favorable memories. Will be keeping my eye peeled for future copies."

(Signed) Sincerely,
Lt. Ernest F. Lilek, U.S.N.R.
Aerology
Fairwing Six—c/o Fleet
Post Office, San Francisco,
California.

Lindgren, Ernest F., now a PFC, has been in service since December, 1942, and has been overseas with the engineer corps since November, 1943. He was employed in an architect's office before entering the army. Ernest's home is at 2626 Lunt avenue, Chicago.

Professor Schommer was the recipient of this very interesting letter which reads as follows:

"Dear Mr. Schommer:

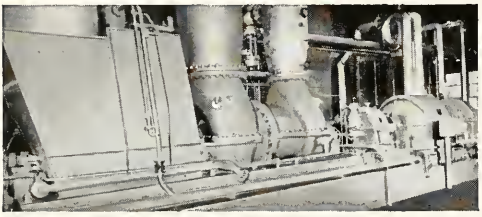
"I was very glad to receive your letter and take pleasure in replying. Your description of spring brings a touch of nostalgia for I remember well the distinctive aromas of the south side. I dropped in to visit the old school July 2, but things were idle. Unfortunately, my leave had coincided with your vacation. On my next leave I'll hope for better luck. By that time, however, the campus should be back to its civilian status for I don't expect to return for a long time.

"I'm always very happy to receive any news from Armour. You'll be interested to know that Armour men are all over the world. I'm on submarine relief crew duty here and much to my surprise I recently

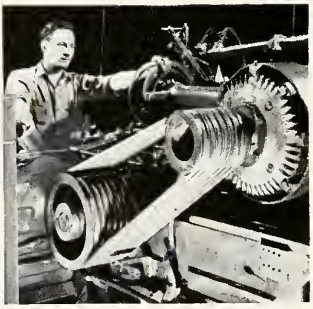
"MADE IN AMERICA" IN THR

Man's Mightiest V

How Allis-Chalmers engineering and equipment helped U. S. Industry solve the biggest production problem of all time... 3 important A-C developments that greatly speeded the job!



1. **A-C GAS TURBINES** in U. S. oil refineries helped mass produce super aviation fuel for Uncle Sam's fighting planes. Called "first really new kind of power plant in 50 years," gas turbines are already predicted for locomotives, ships, many other post-war machines.



2. **MULTIPLE V-BELTS,** invented by Allis-Chalmers, drive 75% of all U. S. machines turning out weapons of war. Since 1941, thousands of guns, tanks and planes have been produced with their help—*with tremendous power savings!*

3. **A-C MERCURY ARC RECTIFIERS** were important factors in breaking the aluminum bottleneck after Pearl Harbor. They provided a cheap, fast way to convert alternating to direct current for mass production of aluminum and magnesium for war planes. Helped build the air armadas that blast the way for U. S. invasion troops!

"ENGINEERING THAT AIDS ALL INDUSTRY FURTHERS AMERICAN GOOD LIVING"

OVER 1600 PRODUCTS

Supplying the Worl
Industri

ALLIS-CH

met Hugh Story, M.E. '43, who is an officer aboard the U.S.S. Bluegill. He said to give you his regards and he'd like to hear more about school. I also met Herman Krantz, Co-op, '43, who is on the U.S.S. Lapon, who feels the same way. I expect to be going out soon myself for present duty is temporary. I'd like to have you note my new address for your letter is dated four months ago. Please pass it on to the Technometer.

"Your promise of postwar jobs is very reassuring and rest assured, I intend to take you up on it. If my postwar position keeps me around Chicago, you can expect to see my face in high school for the courses that the Technometer listed are varied enough to be of value regardless of what my work may be.

"The progress you've made on the building program is gratifying. When our new campus is completed I feel that Armour and her reputation will rise to even greater heights and I feel proud to be an alumnus."

(Signed) Yours Sincerely,
HERM HANSEN, LT. (jg)
Sub, Div. 122
F.P.O.
San Francisco, California

The following letter was received by the Alumni office from ERNEST P. KOCHALE, E.E., a private in the U.S.A. The letter reads as follows:

"Dear Sir:

"After two and a half years as a spotweld development and manufacturing process engineer for Lockheed Aircraft Corporation; the army has finally gotten me. Please address all publications to my new address. My best regards to the class of '42' especially those good old 'juicers,' I ran into Walter Mathews, M.E. '42, in San Diego a few months back and worked with Richard Hruda, John Kupland, and Tom Sweeney at Lockheed but know little about the rest of the class."

(Signed) Best Wishes,
PRIVATE ERNEST P. KOCHALE
Co. F 221st. I. T. B.
Camp Blanding, Florida.

1943

According to recent information from his father, JOHN R. LE VALLEY, JR., M.E., has been wounded in action on a destroyer in the Mediterranean. His present address is:

ENSIGN JOHN R. LE VALLEY, JR.
Naval Hospital
Charleston, South Carolina.

From RAYMOND F. SMITH, JR., M.E., an ensign in the U.S.N.R. was received a very interesting letter which reads as follows:

"Gentlemen:

"Since having been graduated from Illinois Tech, I am now coming to the realization of just how much our school has done for me. The friendships begun, and the educational foundation bestowed upon the student at Illinois Tech, are invaluable. My best regards to you men and women of the Alumni Association, and good wishes for this effort you are putting forth for a newer, larger, and greater Institution.

"Our class of October, 1943, is probably well represented in the services by now, and I would like to say hello to the lads of I. I. T. wherever they are serving in this National effort. I am in the Aviation Gunnery Officers school here at Jacksonville, learning armament, electrical, hydraulic, and optical ordnance operation. Life here has its pleasant side—with Florida palms, flowers, and scenic spots like Silver Springs, Old St. Augustine, and Daytona Beach. People are quite friendly here, and invitations to dinner, beach and house parties balance nicely the training program we are engaged in.

"Have just returned from a 3,000 mile tour by air, of Florida Air stations, in connection with some of our latest optical ordnance equipment; flying as observer over the coral ledges of Key West, boarding new Fleet submarines, and swimming in the Gulf Stream off Pensacola, made this assignment doubly interesting. An all too few days spent boating and swimming off Miami Beach, in beautiful Biscayne Bay completed this trip, a memorable one for me.

"Would you convey my very best regards and congratulations to President Heald, Dean Peebles, 'Uncle' John Schommer, and to each one of the Faculty, for the place they are filling in the ranks of the American Educational movement. With such leadership, a new School and a new Nation will go onward to higher attainments, in a new world founded upon the Four Freedoms for all men.

"Hoping to receive the Alumnus, and occasional news of your progress at home."

(Signed) Most sincerely yours,
ENS. RAY F. SMITH, JR., U.S.N.R.
A.G.O. 611-N.A.T.T.C.
Jacksonville, Florida.

1944

The following letter was received from JOHN M. BEHRMANN, M.E., A.A.F., 3704, Base Unit, Sec. (305) Box No. 73, Keesler Field, Biloxi, Mississippi:

"Dear Mr. Schommer:

"Thank you very much for your continued interest in me and your interesting letters and pamphlets.

"I've been receiving your letters regularly but as usual have failed to keep you posted on my army life and experiences.

"At Sheppard Field I took my Airplane Mechanics Training as a PFC. I graduated from there August 16, for gunnery school. I graduated from there as a Sgt. on Nov. 2, 1943 and spent a 14 day furlough with my Mother in Miami.

"Then I went to the Army Air Base, Salt Lake City, Utah, to be assigned to a combat crew. On January 4, 1944 I was assigned to a crew as Aerial Engineer-Gunner and sent to Peterson Field, Colorado for combat training. Our crew was from all over the U.S.A. and our pilot was 1st Lt. Irwin W. Miller of Belleville, Illinois. I made S/Sgt. while there.

"While I was there I married a girl from Glenview whom I had been going with for six years. That was Jan. 26, 1944. April 6, 1944 we left there and April 15th we went overseas.

"After various training schools, etc., we finally got to our Bomb Squadron on May 25, 1944. We were in the 409 Bomb Squadron, 93 Bomb Group, 8th Air Force stationed in England. More we can't tell.

"Soon after that we started flying our combat missions. We flew 30 missions including D-Day, several over occupied France, and the rest over Germany. For these missions we all were awarded the Europian Theater ribbon with two Bronze Battle stars, the Air Medal with three bronze Oak Leaf Clusters, and the Distinguished Flying Cross.

"We were a very lucky crew. All ten of us flew our 30 missions together and came through without a scratch. We lost airplanes and scratched them up, but always got through O.K. ourselves.

"Then on Sept. 13, 1944, we got back to the good old U.S.A. That is almost a record for a short stay overseas. And for our time overseas I can't say too much good for the Red Cross. They furnished clubs at fields and in towns and really took good care of us. They are really swell!

"When we got back we were given 21 day furloughs at home and I stayed in Glenview with my wife. While I was home I was down to Armour twice. A friend, Frank Graf, is in V-12 there and I visited him. As your letter said, 'the campus sure has changed.'

"After that I repo.ted to Miami Beach to a redistribution center and now I'm at Keesler Field. Here I'll go to school again to freshen up in mechanics. Then I'll probably be assigned to some field as an instructor.

"Till I hear from you again, thanks a lot and So Long."

(Signed) Sincerely,
JOHN M. BEHRMANN
T/Sgt. A. C.
3627001

"P.S. Last invited thought:
"We flew in B-24 Liberators. And while I was home my wife had a baby daughter. Joan Elizabeth is her name. Her birthday was 2:05 A.M., October 9, 1944."

ROSKAM, GEORGE ALLEN, E.E., an ensign in the U.S.N.R. received his commission in the navy in June at Columbia university, and has been assigned to sea duty in the Pacific. He is now at Seattle, Washington, awaiting the completion of his ship. His home is at 217 South Oak Park avenue, Oak Park, Illinois.

SHAFER, HARRY E.E., a S/Sgt. in the U.S.A.A.F. is on overseas duty and has been assigned to the Mediterranean's oldest medium bomb group as tail gunner of a B-26 Marauder. The Marauder group was recently cited twice by President Roosevelt for its pinpoint bombing of Florence and Rome rail yards. His home is at 2128 Cleveland avenue, Chicago.

1945

COX, JOHN A., E.E., has just received his commission in the U.S.N.R. after completing midshipmen's training at Asbury Park, N. J., and Northwestern university. He has been appointed a Diesel officer and will report to his new post after a very brief leave. Ensign Cox enlisted in the naval reserve more than two years ago. His home is at 1116 Elmwood avenue, Wilmette, Illinois.

SMITH, 2ND LT. MALCOLM, Ch.E., navigator on an Eighth Air Force B-17 Flying Fortress, has been presented the Air Medal for "meritorious achievement" while participating in heavy bombing assaults on vital Nazi targets in Europe and in support of advances by the ground troops on the continent. The presentation was made by Col. Karl Truesdell, Jr., of Washington, D. C., a group commander in the Third bombardment division, which was cited by the President for its now historic England-Africa shuttle bombing of Messerschmitt aircraft plants in Regensburg, Germany last summer. Lt. Smith entered the service in February, 1943. His home is at 8705 South Chicago avenue, Chicago, Illinois.

1946

JOHNSEN, DONALD CLARENCE, M.E., graduated from the Naval Air Training Center, Corpus Christi, Texas, and was commissioned an ensign in the United States Naval Reserve. His home is at 5421 School street, Chicago.

ENSIGN DONALD JOHNSEN

KATZMANN, THEODORE RAYMOND, C.E., graduated from the Naval Air Training Bases, Corpus Christi, Texas, and was commissioned an ensign in the United States Naval Reserve. He received preliminary flight instructions at Ottumwa, Iowa. Prior to entering the Navy he served four years in the national guard, and in the Army.

ENSIGN THEODORE KATZMAN

Courtesy Appreciate America, Inc.

1. Your telephone in peacetime reaches 95% of the world's telephones and over 26,000,000 in the United States today.

2. You fly with greater safety because of radio telephony between plane and ground —demonstrated by Western Electric in 1917.

3. You ride more safely on the nation's railroads because of Western Electric train dispatching telephone equipment.

4. You hear radio news and entertainment. Since radio began, W. E. engineers have helped build broadcasting equipment.

Out of 75 years of manufacturing experience

5. You enjoy added protection today thanks to Western Electric inter-city police teletype, and radio in police cars.

6. You can enjoy talking pictures—made commercially possible back in 1926 by Western Electric development.

7. The hard of hearing can live more fully with a Western Electric hearing aid, perfected through telephone research.

8. You will enjoy television. This picture shows how W. E. equipment sent images by radio as long ago as 1927.

...come these contributions to better living

For many years, Western Electric engineers have devoted their skill to the production of telephones and the vast network of telephone equipment used by the Bell System. At the same time they have developed the manufacture of related products which also have contributed materially to better living. Some are pictured here.

Today Western Electric engineers are doing their greatest job—guiding the production of huge quantities of electronic and communications equipment that help our fighting men win battles—help save American lives—help maintain the vital home front communications networks, and bring nearer the day of final victory and peace.

When that day comes, the men and women of Western Electric will resume their 75-year-old job of making communications equipment to further enrich your life.

1869 1944

75TH ANNIVERSARY

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

Buy all the War Bonds you can—and keep them!

WITH THE CLASSES

1897

The Alumni office has received word that Frank D. Sheibley, E.E., has been retired and now lives on a farm at R.F.D. No. 1, Hudson, New York.

1898

Mac Clyment, Harry A., E.E., informs us the firm with whom he is associated, The Lamoot Chemical company, has moved to 2505 West Sixth street, Los Angeles 5, California.

1905

Harper, Robert Brinton, Ch.E., vice-president in charge of research and testing, was the 1944 recipient of the Honor Scroll award which is presented each year by the American Institute of Chemistry to an outstanding member of the chemical profession. The scroll was awarded at the annual testimonial dinner of the Institute, held in the Morrison hotel, Chicago, on October 6, "In recognition of his outstanding contributions to the gas industry as an organizer, executive, and scientist."

1908

Rathje, Frank C., A.C., has recently been nominated vice-president of the National City Bank of New York by American Bankers association.

1915

Lubvey, Louis, Arch., informs us that he is now a structural draftsman with the Navy department bureau of yards and docks, and resides at 5511 North Christiana avenue, Chicago.

1916

The Silver Star for "exceptional heroism" in action against the Japanese at Guadalcanal and the Russell Islands, was awarded to Brig. Gen. Walter G. Farrell, A.C., at a recent ceremony "somewhere in the Central Pacific." Admiral William F. Halsey of the Third fleet, made the award. Farrell's family is residing at 458 Belmont avenue, Chicago.

1918

Kobak, Dr. Alfred, A.A., resides at 3521 North Lakewood avenue, Chicago.

1920

Hall, Thomas W., M.E., resides at 764 Scotland Road, Apt. 7, South Orange, New Jersey.

1922

Watt, Chaplain James, C.E., is now a captain in the United States Army. His present military address is:

Captain (Chaplain) James Watt 0529785
Ships Complement
N.O.P.E.
New Orleans, Louisiana.

Wetherbee, George D., M.E., is a captain in the United States Army. His present military address is:

Captain George D. Wetherbee
139 Irvington Street
Washington, D. C.

The Captain informs us that this address is only temporary.

Pardue, Bishop Austin, A.S., was the principal speaker at the Founder's Day, marking the forty-seventh anniversary of the National Congress of Parents and Teachers, which was observed at an all-day meeting of the Allegheny County Council of Parents and Teachers in the Roosevelt Hotel. Bishop Pardue resides at 5565 Aylesboro avenue, Pittsburgh, Pennsylvania.

1923

Hedges, Albert R., Ac., is residing at 1921 29th South, Seattle, Washington.

Eitel, Otto K., M.E., vice-president and managing director of the Bismarck hotel, Chicago, has been appointed a member of the Hotel Industry Advisory committee. Before he entered the hotel industry, Mr. Eitel studied in Europe and took mechanical engineering at the Massachusetts Institute of Technology, and the Armour Institute of Technology. He started his hotel career at the Hotel Astor, New York, and, while still in his twenties, was appointed managing director of the Bismarck hotel, serving in that capacity for seven years. By the time he was 32, he had been appointed general manager of the Stevens hotel in Chicago. He remained with the Stevens for six years. He then became managing director of the Beverly-Wilshire hotel in Beverly Hills, California. In 1941 he returned to the Bismarck hotel to assume his present position. In Chicago Mr. Eitel has been active in many community affairs, holding prominent offices in the Community and War Fund drives, and the Greater Chicago Hotel association. He is at present chairman of the OPA Regional Restaurant Advisory council.

1924

Graser, Theodore N., A.A., vice-president and treasurer of the Cochrane Steam Specialty company, now resides at 274 Manning street, Needham, Massachusetts.

Anderson, Elmer L., F.P.E., gives his present business address as:

Mr. Elmer L. Anderson
Insurance Broker & Engr.
30 West Washington St., Rm. 711
Chicago 21, Illinois

1926

Appointment of William M. Kauffmann, M.E., as assistant to the chief engineer in charge of Diesel engine development for Mack Trucks, Inc., has been announced by L. C. Josephs, vice-president and chief engineer of Mack. In his new capacity, Mr. Kauffmann will supervise the truck firm's greatly enlarged facilities for Diesel research and development. He previously was assistant chief engineer of the engine research and development division of the Worthington Pump and Machinery Co., Buffalo, and chief development engineer of Baldwin De. La Vergne, Philadelphia, and research engineer of the National Transit Pump and Machine corporation, Oil City, Pa. Other important posts held by Mr. Kauffmann during the past 20 years include that of chief design engineer of Baldwin De. La Vergne, Philadelphia, and research engineer of the Superior Engine division of the National Supply Co., Springfield, Ohio.

William M. Kaufman

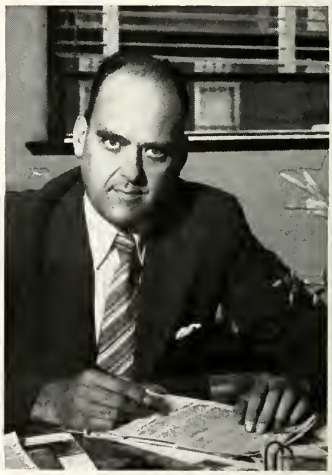
1927

Martens, Leroy P., C.E., is now a major in the army air forces. His present military address is:

Major Leroy P. Martens
Sanitary Engr.-Sec. "E"
2530th A.A.F. Base Unit
Selman Field, Monroe, La.

1928

The appointment of Willard A. Anderson, C.E., as mechanical superintendent of the government printing office at Washington, D. C., to succeed to the post made vacant by the sudden death of Alfred E. Hanson was recently announced by A. E. Giegengack, public printer of the United States. Mr. Anderson is particularly well equipped to administer the duties of his new assignment through his long association with the government printing office. He became identified with the federal government in November, 1928, when he was engaged as assistant structural engineer in the office of the supervising architect of the treasury department. He transferred to the government printing office as assistant structural engineer in October, 1930, and has been on the staff continually since that date. He was appointed assistant maintenance engineer in May, 1932, and became associate structural engineer in April, 1936. He was elevated to the post of construction engineer in September, 1938, and subsequently assumed the duties of assistant mechanical superintendent in July, 1940. His appointment as mechanical superintendent became effective September 1, 1944.



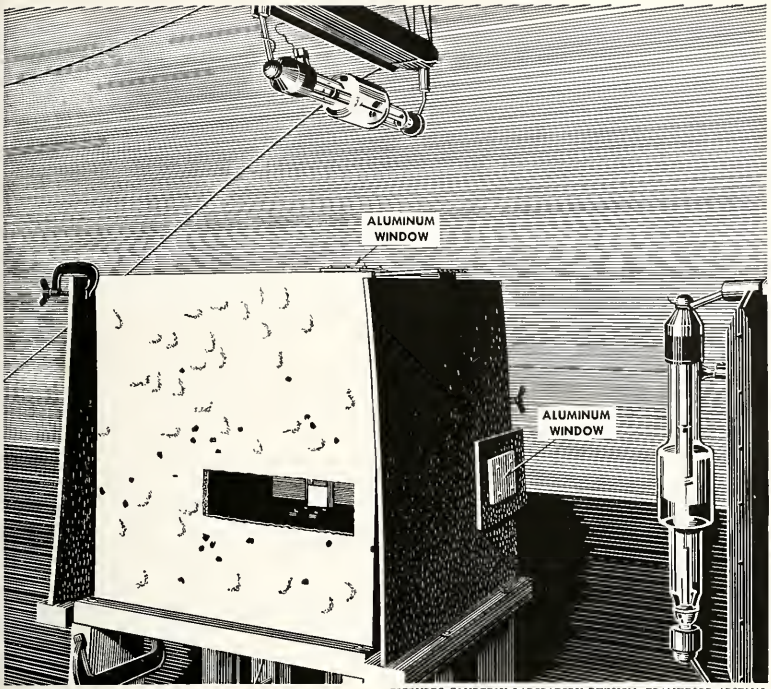
Willard A. Anderson

The Alumni office received word that due to the retirement of James W. Doyle as president of James W. Doyle, Inc., Mr. Everett E. Gramer, E.E., has assumed Mr. Doyle's financial interest and has taken over the executive operation of the company as president. Mr. Gramer, who has been associated with the transformer and coil industry since 1928 desires to thank all of his business associates for their many courtesies and shall endeavor to justify their continued confidence and co-operation.

1929

Tenner, Harvey O., M.E., formerly in the equipment and supplies unit, dealing with pricing problems of office and commercial furniture, has become head of the furniture price unit, succeeding Edward J. Wormley. Mr. Tenner was head of procurement for Montgomery Ward and Co., before going to OPA. His present residence address is 5034 Benning Road, S.E., Washington 19, D. C.

Stellar, Raymond Frank, Civ.E., is a civil engineer with corps of engineers U. S. Army, 21st Virginia avenue, Chicago, and resides at 3730-39th street, N.W., Washington, D. C.



PICTURES COURTESY LABORATORY DIVISION, FRANKFORD ARSENAL

High-speed X-ray picture of cal. .30 bullet penetrating 1/2 inch thick armor

High-speed X-ray picture of same bullet 20 millionths of a second later

14,285 times quicker than a wink

KEEPING UP WITH *Electricity*

MAN-MADE HURRICANE BLOWS OUT ELECTRICITY. Engineers can now "blow out" electricity as easily as you extinguish the flame from your cigarette lighter. Circuit breakers built by Westinghouse unleash a 600-mile-an-hour blast of compressed air to snuff out powerful short-circuit arcs and prevent damage to vital electrical equipment on power lines. The hurricane of air can smother a 1,000,000-kilowatt electric arc in less than a hundredth of a second.

REPRESENTATIVES OF 257 PRE-WAR PROFESSIONS, businesses, and trades are now employed at the Westinghouse operated Naval Gun Plant at Louisville, Kentucky. Included are: former circus performers, several embalmers, a former professional hill-billy musician, and a pipe-organ builder. Despite their unusual peace-time occupations, all here have been able to learn the amazing high precision needed in making Naval guns.

A NEW GUNSIGHT LAMP that enables American gunners to aim *directly into the sun* and yet fire with deadly accuracy has been developed for the Army and Navy by Westinghouse Lamp Engineers. Former gunsight lamps allowed gunners to aim within only 15 degrees of the sun, leaving a dreaded "blind spot."

FREE . . . "Engineering Highlights of 1944"—a 32 page book, filled with interesting articles on new developments in electrical research and engineering in wartime. Write: Westinghouse Engineer (EC-124).

Westinghouse research engineers have developed an ultra-high speed X-ray tube that makes possible X-ray pictures, taken at the terrific speed of *one-millionth of a second.* These pictures show armor-piercing bullets penetrating ½ inch of solid steel armor plate.

The action is 10,000 times faster than any conventional X-ray—literally 14,285 times *quicker than a wink!*

Secret of this revolutionary X-ray is the new type tube that can handle a jolt of 2000 amperes, at 300,000 volts. This is applied in a flash by electrostatic condensers—creating a tremendous surge of *X-radiation.*

With this new X-ray, U.S. Army ballistic experts can "freeze" the image of a bullet, while it travels within a gun barrel at 2600 feet per second—or study the action of projectiles as they smash through armor plate.

When peace returns, this new example of Westinghouse *skill in research* will enable machine builders to study the strains in rapidly moving parts—improve performance and increase the life of peacetime products.

Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pennsylvania.

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

TUNE IN: John Charles Thomas, Sunday 2:30, EWT, NBC Ted Malone, Mon. Wed. Fri., 10:15 pm, EWT, Blue Network

1930

ROWLEY, EDWARD ROBERT, M.E., employed by the Magnesium Reduction Co., is now plant manager. He now resides at 322 North Main street, Bowling Green, Ohio.

KOVARIK, JEROME H., M.E., a lieutenant (jg) is now in the Bureau of Ships, Washington, D. C. His wife resides at 4719 South 29th street, Fairlington, Arlington county, Virginia.

1931

VARENHORST, FRANCIS GILBERT, E.E., has a new position as engineer with the Bell Telephone laboratories, 463 West street, New York City. New York. He resides at 501 Cumberland street, Westfield, New Jersey.

1933

CARLSTROM, ROY W., F.P.E., a lieutenant (jg), whose home is 6207 North Artesian avenue, Chicago, was one of the officers graduating from the Chemical Warfare School, 21st Toxic Gas Handler's course. Some of the subjects studied by the navy officers attending the course were protective clothing, decontamination, treatment of gas casualties, and chemical warfare material and tactics. Upon returning to their stations these navy and coast guard officers will serve as unit gas officers and chemical warfare instructors for their organizations.

1935

Word was received from LAWRENCE W. DAVIDSON, Arch., of his new position in business. He was promoted to the main office from the engineering department. His address will be American Can company, 230 Park avenue, New York. He resides at 824 Bronx River Road, Bronxville 8, New York.

1937

LUNDBERG, ROBERT M., Chem.E., informs us of his new temporary military address: Ensign Robert M. Lundberg, Co. L, Batt. 3, Brks. 11, Camp McDoneugh, Plattsburg, New York.

1938

KUEHNERT, THEODORE J., E.E., informed us of his change in business address. He is now an electrical engineer at a 20-foot wind tunnel unit, Aircraft Laboratory, Wright Field, Dayton, Ohio. He resides at 905 Lexington avenue, Dayton, Ohio.

THEODORE J. KUEHNERT

1940

The following letter was received from ERNEST BASIC, E.E., a lieutenant in the U. S. Army. The letter reads as follows.

"Dear Sirs:

"First, of all, greetings to my E.E. A-40 classmates. I've lost track of all of them, but that isn't surprising, seeing as I have spent only seven months in the United States since Pearl Harbor. After a thirteen month tour in the R.A.F., as the technical officer of a night fighter station, a transfer to the United States Army resulted in my present assignment as commanding officer of an aircraft warning radar station in the Aleutians."

(Signed) 1ST LT. ERNEST BASIC
713 AWS
APO No. 729
Seattle, Washington

1941

SALINY, EMIL, E.E. and YURSIS, JR., ALEX, E.E., have informed the Alumni office of a change of address due to their being transferred to the Lincoln branch of Western Electric company, where they are employed as test set design and development engineers. Their following addresses are: Emil Salinv, 2928 South 25th street, Lincoln, Nebraska, and Alex Yursis, Jr., 1916 Sumner street, Lincoln, Nebraska.

1942

Sonny Weissman was the recipient of the following letter:

"Dear Sonny:

"Hello again, Pop, and muchas gracias for your welcome communique of 25 September. It took quite some time to get here because shipping space has been used for more important things lately—as you can probably judge from current new reports! The———— are sure getting their ears pinned back now—and but good.

"Bumped into two old-timers out here recently—Ed Knorring and Bud Murray. Sure was surprised to see them and we had a great time shootin' the breeze. First thing Ed wanted after he found out I was here was for me to fix the two of them up with some nurses! Cripes, that I.I.T. background never wears off! I couldn't oblige because I don't know any of the handful we have here, but we still had a big time talking over old times.

"Still working at a hectic pace but the results are beginning to show now. Otherwise, the situation is much the same. But nuff said, give my best to Ginny and Nancy and say hello to the boys you bump into."

(Signed) Adios
Lt. M. F. PLEVA, U.S.N.R.
A.R.O.U., No. 1, c/o F.P.O.
San Francisco, California

The following letter was received from EDWARD H. COLLENDER, Ch.E., and reads as follows:

"Dear Sonny:

"Just got your epistle of Sept. 25th and first off I want to claim that prize baseball cap you were sending to Don Keigher. The HP (Halsey Powell) has been camping in Tojo's backyard for so long, the scenery seems more like home than 33rd and Federal. Furthermore, I haven't seen anything of Keigher or his ship.

"We celebrated our first birthday the day before yesterday (at General Quarters). Seems like only yesterday we were freezing in the Brooklyn Navy Yard, going through the commissioning ceremonies.

"Summing things up—in the last five months we have never tied up to a dock. I have been ashore a total of about five hours (three of which were on official duty) and have had a total of three bottles of beer (warm beer). And it is almost two months since I had that beer. And I also claim to have bettered Kiegher's claim by far—Now do I get that baseball cap?

"Well, Sonny, as usual I haven't got a darn thing to write about, but look forward to your home town dope sheet to cut me in on current developments. It seems that most of your correspondents are the later classes. Speaking of correspondents, we had one aboard the other day, Reed of INS. He wasn't around very long though, so I didn't get a chance to talk to him. Have also run into Bob Feller out here. You know that guy that used to be a pretty good pitcher in the American League. Well I'm out of paper now got to quit."

(Signed) Lt. (j.g.) EDWARD H. COLLENDER
U.S.S. Halsey Powell (DD 636)
c/o Fleet Post Office
San Francisco, California

1944

Sonny Weissmann was again the recipient of this very interesting letter:

"Dear Sonny:

"This is just a little note to let you know how people on the other side of the world are and to tell you some of my adventures since I left the Windy City.

"As you know, I left Chicago on Sept. 23rd. The United air lines lived up to their name and got me into Frisen (or should I say the outskirts of Frisco) safe and sound the next day. When I arrived at the airports there was a message from Lou Boldt awaiting for me; he and Don Maihock had arrived the day before. They had a room at a hotel already, so all I had to do was register. The three of us lived together all the time we were in Frisco. The time was our own; all we had to do was report to the Navy department every day or so and call the hotel whenever we went out anywhere to see if there were any messages for us from the Navy. During the day we visited all the points of interest, both scenic and otherwise (chamber of commerce propaganda), and in the evening we did our best to see the night life. All the bars close at midnight. As far as I'm concerned nothing can beat Chicago's night life. The city is a nut house, prices are terrific, but no one gives a darn as the fellows are either going out or coming back into the States. The Spirit of '49 is everywhere. Lou left Frisco on the 21st of Sept. I left on the 23rd, and Don was still there when I left, so I don't know when he left. As the beautiful (?) merchant ship of ours sailed through the portals of Frisco, the Golden Gate, that fog that has made Frisco famous followed us. That night we missed another ship by only 20 or 30 yards—too close for comfort, most of our cargo was high explosives. Aboard this ship there were 80 officers as passengers. There were 4 of us in a stateroom about the size of a closet—tight, but cozy. We all got to know one another rather well. How could we help but know each other, when you had to ask the other guys to sit down when you shaved; if you didn't you might shave them. Some of the fellows got quite sick, but I, much to my surprise, survived the perils in ship shape order.

"During my wanderings in the Pacific I visited Honolulu and Waikiki Beach. Honolulu is strictly for the birds, but Waikiki and vicinity is rather nice and more like the Hollywood version of the Islands. Honolulu is packed with service men and Japs. I was told that the population of the islands was 66% Jap—I think this estimation is a little low. The streets are lined on each side with open air joints consisting of hot dog joints, penny arcades, places where you can get your picture taken with a babe who is supposed to be a real hula dancer (B.S.), etc. This town reminded me of the Beachwalk in Atlantic City. One day two of my buddies and I went native and went surf board swimming at Waikiki. We rented surf boards, paddled out about a quarter of a mile to where the surf begins to break, and then laid on our boards to rest up after all that exertion. As far as I could see the object of this game is to wait until a breaker comes along, then you paddle like h— toward shore to get up momentum. When you get up enough momentum, all there remains to be done is merely stand up on the board and steer it by shifting your weight. If I didn't see other people do it I would say that it was impossible. It is quite a thrill, however, to watch the natives and the fellows that have been stationed in the Islands for awhile; they are very adept at it and can do anything with the boards. The Beach itself is not so hot as the bottom is covered with sharp coral and there is a lot of sea weed.

"The port that we hit next after the Islands was made up of a group of atols, which was in Jap hands about 6 months ago. These atols were really given a blasting. There was no shade on any of them and all the water was obtained by distillation units. The first day in port, I went swimming off the side of the ship, but I changed my mind in a hurry when two sharks were pointing out to me about 20 or 30 yards from the ship. I was told that they were only sand sharks and wouldn't harm a man. But who was I to give them a chance to break a long standing tradition? After this I went swimming ashore. On the main atol they had a nice officers' club made out of a 40x100 quonset hut; here they had a nice beach and you could get all the beer and mixed drinks you wanted between the hours of 1430 and 1730 —now you know where I spent most of my time.

"When we left this god-forsaken hole, we traveled in a convoy. It was a good feeling to see other ships near you instead of miles and miles of blue, blue ocean. For once we could stay on one course and not change course every 10 minutes or so to evade detection.

"I have now reached my final destination. I've been here for 3 days now and I'm still aboard. I have been instructed to remain with the ship until it is unloaded. I think though that I will be taken off tomorrow or the next day. Yesterday I went ashore to look the island over. It is rather nice for an advance base. The island has a lot of vegetation and there is a breeze blowing all the time. Whenever you go ashore you have to carry a gun, so I had to lug my .45 with me; the reason for this is that there are still some Japs holed up in the hills. After looking the place over I went to the officers' club where I had some ice cold Budweiser in cans. I bet when I hit the States again I won't know how to drink brew out of a glass. I can't tell you where I am just yet. I might be able to tell you in my next letter as the censorship rules aren't as strict when you are based on shore. I don't know how long I'll be stationed here, but I doubt if it will be here for long. This is only the headquarters for the brigade and as soon as I report in I'll probably be sent out with a battalion.

"I'll knock off for now, Sonny, but I prom-

ise that I'll write again as soon as I can. The next letter might be more interesting as I might be able to tell you more about where I'm at. Bye for now."

(Signed) Ens. T. J. O'Leary, CEC USNR
6th Naval Constr. Brigade
c/o F. P. O.
San Francisco, California

1945

The following letter was received from Joseph A. Chamberlin, CH.E., and reads as follows:

"Gentlemen:

"I am sending you my military address which is written on the enclosed letter which you sent to me.

"At the present time I am at Officer Candidate School, for the Transportation Corps, located here at the New Orleans Army Air Base. If things go well, I should graduate on December 20, 1944, and hope to come home for Christmas."

Sincerely yours,

(Signed) Cand. Joseph A. Chamberlin
16129536
Class No. 31 5th Platoon
TC School, N.O.A.A.B.
New Orleans 12, La.

The following letter was sent to the Alumni office concerning Henry A. Dirksen, CH.E. The letter reads as follows:

Mrs. H. A. Dirksen
4721 Greenwood Ave.
Chicago 15, Illinois.

Dear Mrs. Dirksen:

"Your son is among a new group of men recently assigned here to the Navy's radio school. He has probably written to you telling you of the advanced training which he is receiving in radio communications.

"You have every reason to be proud of him because of his selection for this type of work. He has been chosen because the Navy believes that he possesses special abilities which qualify him for the important post of a radio operator with the Navy.

"During the nineteen weeks he will be here he will be working very hard. Forty-four hours of every week are devoted to the classroom, laboratory, and organized physical education. He must become proficient in the sending and receiving of coded messages, and he must learn typing, radio procedure, and naval indoctrination. That's a rigorous schedule, but it is preparing him for a position of great responsibility.

"Perhaps you would like to tell your son's friends what he is doing. Your local newspaper is always interested in the progress of men in the Navy, and would appreciate knowing about your son. If any items are published, we would be happy to receive a clipping.

"One of the brightest moments in a Bluejacket's day is "Mail Call"—if he gets a letter from home. He like a "newsy" type of letter—one that is filled with information about his family and friends. Any encouragement which you can give him will go a long way in helping him in his work.

"You may rest assured that your son is receiving the finest training the Navy has to offer, and that we will do all we can to make his life here a happy one."

Sincerely yours,
(Signed) L. K. Pollard
Captain, USN
Commanding Officer

Henry A. Dirksen

The Alumni office has received the following news release:

"An Eighth Air Force Bomber Station, England—First Lt. Malcolm Smith, CH.E., of a B-17 Flying Fortress of the 95th Bombardment Group, has been awarded the *3rd Oak Leaf Cluster* to the Air Medal for "meritorious achievement" while participating in Eighth Air Force bombing attacks on vital German industrial targets, and on Nazi airfields, supply dumps and emplacements in support of advances by Allied ground forces on the Continent. The presentation was made by Colonel Karl Truesdell, Jr., of Washington, D. C., group commander.

"Lt. Smith is a member of the Fortress group which led the first American bombing attack on targets in Berlin, and which was cited by the President for its outstanding bombing assault on railroad marshalling yards at Munster, Germany, in October, 1943. As a component of the distinguished Third Bombardment Division, the group also shared in a Presidential citation given the entire division for its historic England-Africa shuttle bombing of an important Messerschmitt fighter plane plant at Regensburg, Germany, in August of 1943.

"The lieutenant is the son of Mr. and Mrs. William Smith of 8705 South Chicago avenue, Chicago."

MARRIAGES

1930

Announcement has been made by Mr. and Mrs. John Barnett, of the marriage of their daughter, Harriet, to Walter Lockett Filmer, E.E. The marriage took place in October. Mr. Filmer is employed as an engineer with the Bell Telephone laboratories at Kearny.

1938

Announcement is made of the marriage of Miss Mary Jane Cody of Chicago and Captain Stanley E. Healy, Jr., M.E., of the Hotel Kimball and Chicago, on October 3, 1944. Captain Healy, was called to active duty in April, 1942. He served overseas in the North African campaign and was assigned to the Springfield Armory in June.

1942

Mrs. Marion Budd has announced the marriage of her daughter, Catherine Beers, to Lt. Paul E. Zwoyer, Co-op, in September.

Mr. and Mrs. David M. Fine of Waveland Avenue, announce the marriage of their daughter Etta Mae to Lt. Seymour Saperstein, M.E., the son of Mrs. Beatrice Saperstein of Pine Grove Avenue. The bride is a student at Northwestern university. Her husband is now stationed at Grenier Field, N. H.

1944

Ensign Lowen Shearer, M.E., son of Mr. and Mrs. Frank L. Shearer, Gilbert Terrace, has recently married the former Jean Mortensen, daughter of the Axel Mortensens of Clinton, Iowa. Ensign and Mrs. Shearer are making their home in Ithaca, New York, where he is taking training at Cornell university. Ensign Shearer was listed in the 1943 edition of "Who's Who in American Colleges and Universities."

1946

Mrs. Marsh W. Bailey, Washington, Iowa, has announced the marriage of her daughter, Miss Josephine M. Bailey, to Elwood F. Meschter, Jr., son of Mr. and Mrs. Elwood F. Meschter, White Plaines and Kinderhook. The marriage took place Saturday, September 9, in Washington, Iowa. Meschter studied at New York State College for Teachers and the University of Chicago. He is in the engineering department of the Link-Belt Company, Chicago, Illinois.

OBITUARIES

1902

Birkhoff, Dr. George D., A.A., 60, professor of mathematics at Harvard university and internationally prominent mathematician, died November 13, 1944. Born in Overisel, Michigan, he was graduated from Lewis Institute in Chicago in 1902, and from Harvard in 1905. Dr. Birkhoff received his Ph.D. from the University of Chicago in 1907. He was married to the former Margaret Grafius of Chicago in 1908.

1908

Flanders, Paul, Ac., a commander in the United States Navy, died in Washington, D. C., September 24, 1944. In World War 1, he enlisted in the Navy and retired with the rank of lieutenant. In 1939, he returned to active duty with the rank of lieutenant commander and began an intensive study of mine warfare. After service in the San Francisco area, he was promoted to full commander. He made his home at 601 O'Farrell street, San Francisco 9, California.

1923

Sutherland, Mrs. William H., H.E., has died, the Alumni office has been informed indirectly. She resided at 343 Park avenue, Glencoe, Illinois.

1931

Griesman, Albert H., special agent of the Great American group in Minnesota with headquarters at Minneapolis, drowned with a companion while duck hunting on Lake Norway, Minnesota, November 5. The boat turned over in a choppy wind. Mr. Griesman had been with the group since 1939, prior to which he was with the General Inspection bureau at Fargo, N. D. He was a graduate of Armour Institute.

1940

Meigs, Douglas P., Ch.E., died in an explosion at the Philadelphia Navy Yard, September 5. Mr. Meigs, a chemical engineer formerly employed by the American Instrument Co., was working on a secret project for the navy in Philadelphia at the time of his death. He was a fellow of the Armour Institute, the American Chemical Society and the American Institute of Chemical Engineers. Before the war he was employed for a short time at the War Department.

1941

Stretz, Arthur William, M.E., a lieutenant in the U.S.N.R., died in June, 1944. He resided at 2726 West 24th street, Chicago.

MIDWEST POWER CONFERENCE

The eighth annual meeting of the Midwest Power Conference will be held on Monday and Tuesday, April 9-10, 1945. Conference headquarters will be at the Palmer House, Chicago, at which the conference has been held for the past six years. This conference is sponsored by the Illinois Institute of Technology with the cooperation of Iowa State College, Michigan State College, Northwestern University, Purdue University, State University of Iowa, University of Illinois, University of Michigan, University of Minnesota, University of Wisconsin, the local sections of the founder and other engineering societies, and the Engineers' Society of Milwaukee.

The preliminary program of the 1945 meeting is being formulated by Stanton E. Winston, conference director, with the collaboration of Dr. Jesse E. Hobson, director of the Armour Research Foundation, and Dr. William A. Lewis, research professor of electrical engineering. In addition to the opening session, it is anticipated that the program will include sessions on industrial power plants, feedwater treatment, recent developments in heating, recent developments in air conditioning, fuels and combustion, central station practice, the gas turbine, postwar load planning, diesel power, and hydro power, as well as three electrical sessions, the customary joint luncheons with the A.S.M.E. and the A.I.E.E., and the all-engineers dinner.

The preliminary program will be ready for distribution early in February, and will be printed in full in the March issue of this magazine.

(Continued on page 58)

CHEMICAL

(Continued from page 18)

Cytosine desoxyriboside
Coenzyme II
5,6-Cyclopenteno-1,2-benzanthracene
Carbon oxysulfide
2-Chlorofluorene
Diphenyl selenium difluoride
Diethyl telluride
4-Methyl daphnetin
Divicine
2,5-Dimecrapto-1,3,4-thiadiazole
Distearyl sulfone
Desoxyribose
Dithioformic acid
N,N-diisobutyl dithio carbamic acid
3,4-Dihydroxydiphenyl amine
7-Dehydro cholesterol
Decaborane
Ergothioneine
Eriochromcyanine R
Ethyl malonamate
Etioporphyrin
Folic acid
4-Fluoro coumarin
Guvacine or guvacoline
Gheddaic acid
Ginkgolic acid
Tetraphenyl ethane or ethylene
Hydrochupreine sulfate
Hyenic acid
Heneicosanoic acid
3-Hydroxy-△5-cholenic acid
Inosine
Laccol
Laccase and related oxidases
d- or l-Lactic acid
Methyl violegan
Methyl isopropenyl ketone
2-Mercapto-5-sulfo-1,3,4-thiadiazole
Mellitic acid
Methyl nitrite
17-Methyl testosterone
2-Methyl furan
Nicotinuric acid
o-Nitro benzaldehyde
Nornicotine
Ormosine
Phosphocreatine
Phloridzin
Pyrithiamin
Paraxanthine
Pyrazole
Perylene
Quinoxaline
Suprasterol
Sphingomyelin
Stachydrine
Sodium isethionate
Tumenol
Tetrophine
2,2′,2″-Tripyridyl
Thymine
Tyrosinase
2,6,7-Trihydroxy-9-methyl isoxanthone
Urushiol
Uricase
Vasicine (peganine)
Xanthopterin
Yellow Enzyme

Symbol of friendly companionship . . . . .

The perfection of a hundred years of American brewing skill sparkles in every delicious drop of Pabst Blue Ribbon Beer...the very symbol of friendly companionship ...yours to enjoy.

33 FINE BREWS BLENDED INTO ONE GREAT BEER

ELECTRICAL

(Continued from page 15)

AC machines. An eight element and a four element recording oscillograph have made it possible to study machine operation under transient conditions.

The remodeling of the electrical machinery laboratory has made this one of the best machinery laboratories to be found in any college. Almost all of the equipment in the laboratory is new and modern. Sufficient flexibility is provided to permit almost any desired study of a machine. The appearance of the laboratory is thoroughly modern. These factors have increased the capacity and safety of the laboratory, and they should encourage students to want to learn more from their laboratory work.

VETERANS

(Continued from page 21)

ing one's education is not always enough, however. Too often the men have grown a bit rusty in their study habits. They must gradually relearn patterns for study. Thus a man who had been away from school eight years enrolled for a stiff eighteen-hour program. He found the going tough, became discouraged, and had about decided to drop out. When his fellow veterans learned of his problem, they suggested that he talk it over with Dean Tibbals. He was persuaded to drop one of his more difficult courses, but continue in school. Now he's getting along much better. His problem became less formidable when he realized that others had similar difficulties. As the organization grows older, it will have the advantage of prolonged experience in meeting these problems of adjustment and will know better how to advise the newly enrolled veterans.

There is only one woman among the veterans, a former member of the marine corps. She received her basic training at Camp Le Jeune, North Carolina, and was about to begin her duties as a chemical laboratory assistant at the marine base at Cherry Point at the time of her honorable discharge. A freshman majoring in chemical engineering, she hopes to become a metallurgical engineer.

Common memories as well as common study problems are shared by the I. T. Vets. It is in their informal social gatherings that they relive their experiences while in service. One man may relate a humorous incident—how he fell asleep on rifle range and ran out while the firing was still going on. Another may recall with disgust a damp, cold autumn in "sunny California," while a third tells of the time when the water supply was cut off from his camp and each man was allotted a total of one canteen of water daily.

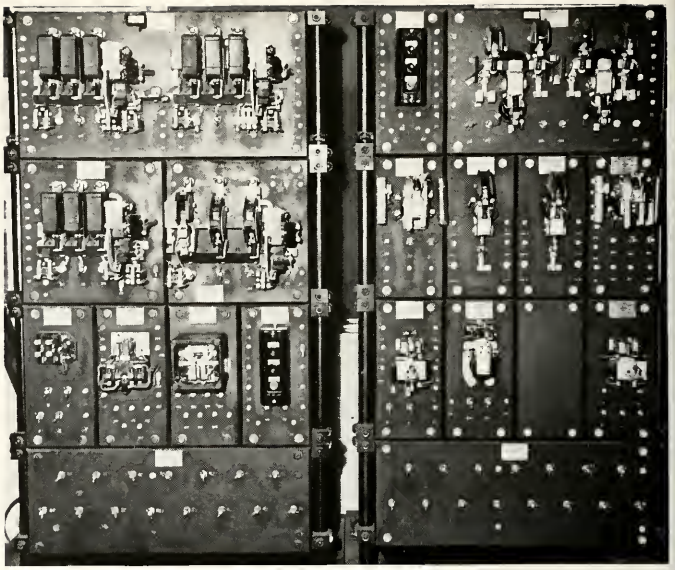


Fig. 6. Motor Control Panels

Some of the men have colorful careers to relive, such as the former marine and Carlson raider who went on maneuvers on islands off the coast of California, served at Guadalcanal, the Solomons, Carolinas, New Hebridies, Esperito, and New Guinea. It was in a raid on an undisclosed island that he was injured in an explosion which lifted him from the ground, hurled him against a tree and rendered him unconscious. Besides a presidential citation he holds the South Pacific, North American, Pre-Pearl Harbor, and Marine Expeditionary ribbons.

Another member of the club is a veteran of the North African campaign who served four years and received the Air Medal and the Purple Heart before his medical discharge. Primarily a radio operator and gunner in the Army Air Forces, he also aided in plane piloting. Early in his career his leg was broken in an air crash. On his release from the hospital he was assigned to the 97th bombing group, the first American unit to reach England. He took part in eighteen bombing missions, many of them in the African invasion. While in a foxhole at an Algerian desert air base, he was wounded by a 500-pound German bomb. He was hopitalized, then returned to the United States and discharged.

It is a long way from a foxhole in Algeria to an engineering lab at 3300 Federal Street, Chicago 16. But it is such distances as these—psychological as well as physical — that must be overcome by millions of veterans when the war is over. In the task of bridging these chasms, the I. T. Vets is proud to play an increasingly significant role.

KNUEPFER

(Continued from page 28)

Other interests which he follows very closely are the Boy Scouts, as he is a committeeman of Troop No. 63, member of the district committee, president of the Thatcher Woods area council of the Boy Scouts of America. He is a member of the American Legion Post 730 of River Forest, Illinois, and of the Oak Park club.

He was married to Ella A. Parrant in 1919 and has two sons and a daughter. Jack T. is in service in France, and Robert C. is in service in New Guinea. The family resides at 918 Jackson avenue, River Forest, Illinois.

Life  FROM A PLASTIC BAG!

THE MAN ADRIFT here is drinking sea water. But it is sea water that he has made drinkable by chemicals and a filter contained in a VINYLITE plastic bag*. The plastic—produced by CARBIDE AND CARBON CHEMICALS CORPORATION—has been made possible by the availability of synthetic organic chemicals, in which this Unit of UCC specializes.

But the story behind VINYLITE plastics is far more than just the history of another chemical development.

Rather, this unusual substance is indicative of the way man can learn—through years of uninterrupted research in the basic and applied sciences—to make better material than nature. It is one more confirmation of the continuing progress that is achieved by co-ordinating research, development and engineering.

The importance of VINYLITE plastic in helping to solve such vital needs as fresh water at sea is typical, in terms of human progress, of the stature already attained by many of the 160 synthetic organic chemicals that CARBIDE AND CARBON CHEMICALS CORPORATION now has in commercial production.

▼

**There are good reasons why a VINYLITE plastic is used in desalting bags. It can't mildew or rust. It is strong and tough, scuff-proof and shock-proof. It is chemical-resistant and sun-resistant. It is lightweight, transparent and flexible. It is non-flammable and cleanable . . . Engineers and executives interested in this material are invited to write for the booklet P-12 "Vinylite Plastic Sheet and Sheeting."*

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York 17, N.Y.

Principal Units in the United States and their Products

ALLOYS AND METALS—Electro Metallurgical Company, Haynes Stellite Company, United States Vanadium Corporation

CHEMICALS—Carbide and Carbon Chemicals Corporation **ELECTRODES, CARBONS & BATTERIES**—National Carbon Company, Inc.

INDUSTRIAL GASES AND CARBIDE—The Linde Air Products Company, The Oxweld Railroad Service Company, The Prest-O-Lite Company, Inc.

PLASTICS—Bakelite Corporation

(Continued from page 29)

occupants in the adjoining box at the opera talking about an uprising. She phoned her maid to bring her clothes to a train leaving in an hour and went to Warsaw on money borrowed from Dr. Sigmund Freud. At the border she hired a broken-down Model T Ford to complete the journey, but she had to get out and walk on frozen swamp because the driver, scared, would not go any further. The taxi she did not hire, because the price was too high, was the one intercepted by revolutionists and riddled by bullets. Floyd Gibbons had chivalrously given up the same taxi to her, hence the next morning he thought she was dead and so reported the rumor to the American Embassy.

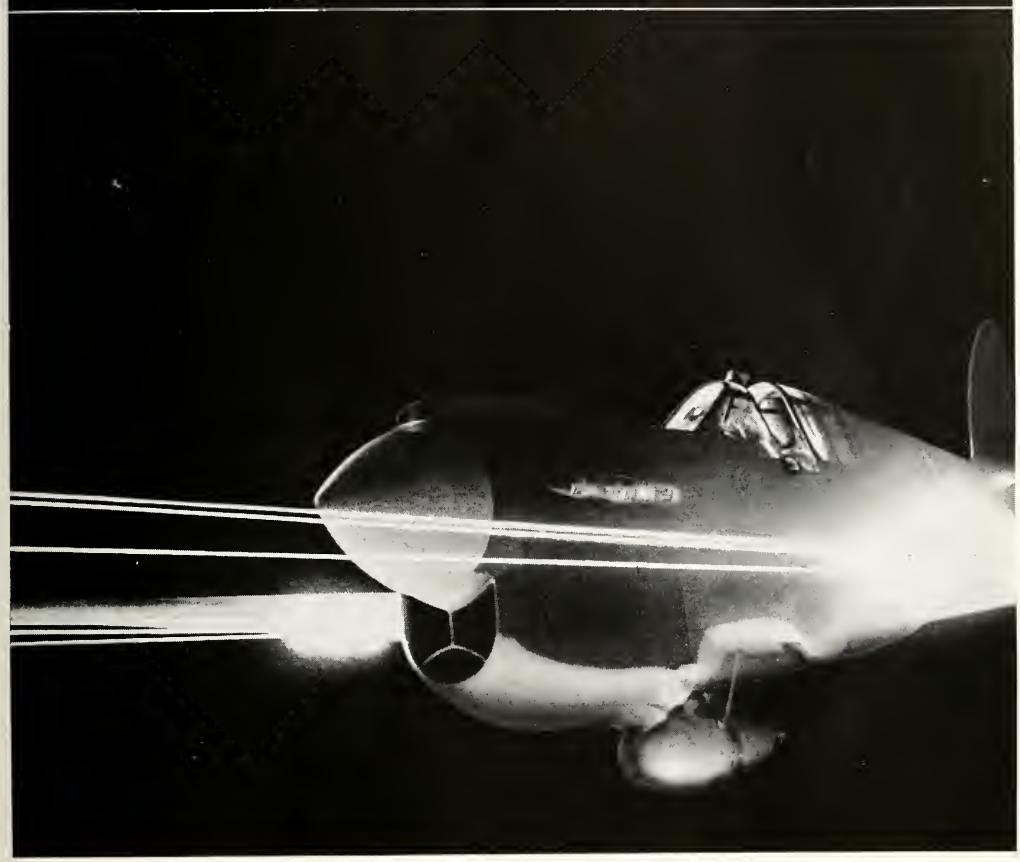
When she watched an uprising in Bulgaria it was from a hotel balcony swept by machine-gun fire. She talked to the Revolutionists in Ireland and got several interviews, including the last ever to come from the hunger striker Terrance McSweeney, the mayor of Cork. She was made Vienna correspondent for the Philadelphia Ledger and subsequently went to Berlin as head of the Ledger Central European Bureau. In Vienna she married Josef Bard (1923), a Hungarian; later they were divorced. She did graduate study at the University of Vienna.

In 1928 she married Sinclair Lewis and returned to the United States. Their son, Michael, was born in 1930. She returned to Europe late in May 1940 to observe war developments in France, Italy, and the Balkans. She could not return to Germany because Hitler had expelled her from the Reich in 1934. Apparently she did not visit Russia either. For the most part, being a mother and writing books occupied her time for the ten year period. During that period she produced: "I Saw Hitler," "Refugees," "The New Russia," "Political Guide," "Once on Christmas" (a small child's book dedicated to her son), "Let the Record Speak" and "Listen House." In view of her early talent for writing, her Lewis classmates are wondering why she has not written the books which they believe she is capable of writing instead of doing column and newspaper work.

Her book "I Saw Hitler" came in for some critical discussion and ribbing. She made a magnificent blunder by predicting that Hitler would never be dictator of Germany, that he was "out of luck." She wrote: "When finally I walked into Adolph Hitler's salon in

(Continued on page 55)

The glass that breaks over Germany...



YOU'VE seen pictures of long range fighter planes with their "belly tanks" that carry extra gasoline. But have you ever wondered how the pilot gets rid of those tanks when they're empty, to decrease weight and gain extra speed and maneuverability?

The big problem in dropping the tank is to sever a tight pipeline connection from tank to plane quickly and positively. This isn't easy with metal, but Corning now makes a fitting from glass tubing that does the trick. The minute the pilot releases the mechanical grips that carry the weight of the tank the glass tubing breaks cleanly and the tank falls free!

War and Corning Research have put glass in a lot of strange places. For instance, there was a time when almost all piping in chemical plants was alloy of one kind or another. Now chemical people have discovered that glass piping is better for many purposes, and Corning has even developed a method for welding it into continuous lengths.

Many of the new uses to which Corning has put glass will persist after the war. For many users have discovered for the first time how really versatile glass is as a material. They are finding out that it has unexpected strengths. That it resists abrasive wear and corrosion. That it is so fatigue proof Corning has even made springs of coiled glass for certain conditions. Perhaps after the war, in whatever business you choose to follow, you will also find that an intelligent application of glass can improve your product or production — Corning Glass Works, Corning, New York.

CORNING
means
Research in Glass

AUTOMOTIVE LAB

(Continued from page 27)

dulum set-up, mounts a six-cylinder crankshaft or other mass such as a propeller. The major use is to determine the mass moment of inertia, say of a crankshaft. Computations from drawings may take a student 10 to 15 hours, an experimental test with computation takes about 20 minutes.

Three accessory pieces of equipment found essential to laboratory testing have been designed and built at the Institute. These are the fuel weighing machine, the multiple-orifice constant-pressure-drop air meter, and the double-insulated spark protractor.

Fuel Weighing Machine

This machine, originally designed and constructed at Armour Institute of Technology, has proven its continued worth and utility over a period of 30 years. It removes the personal equation and is very fast and accurate for determining the weight rate of flow of liquid fuels. It is used for dynamometer experiments to illustrate one type of fuel measuring device. (See Fig. 2.) Other fuel measuring devices supplement this machine to illustrate various fuel-rate measuring devices. These are on the volume basis or a combination volume and weight basis of operation and the rotometer by Fisher and Porter. The fuel weighing machine permits precision tests to be made with as little as 1.40 of a pound of gasoline.

Multiple Orifice Air Meter

In connection with automotive engine equipment, it is very often necessary to determine the rate of air flow into the carburetor. For this purpose the automotive laboratory has devised a multiple orifice air meter which has proven to be practical and accurate enough for most experiments. It is designed with a series of orifices based upon sizes in accord with the money changing system, by having orifices of various sizes. It is possible to measure any flow from 2 to 1500 lbs. air per hour with increments of 2 lbs. per hour, with only eleven orifices. These orifices are slightly modified from the Durley classic orifice studies and finally calibrated against a wet meter. The meter is convenient to use and usually has (without correction) from 2% to 5% error. This error is substantially reduced by correcting for air density.

As with most meters, pulsating flows are difficult to handle. When this meter is connected to a reciprocating engine, even with multiple cylinders, the pulsations adversely affect the readings, sometimes with critical resonance effects. These pulsations have been reduced to a negligible point by the introduction in the airline of an anti-pulsation dampener, made up of two very flexible diaphragms. These were formerly made of dental dam, but because of the rubber shortage and short life, they were changed to a very thin neoprane backed up by a light spring.

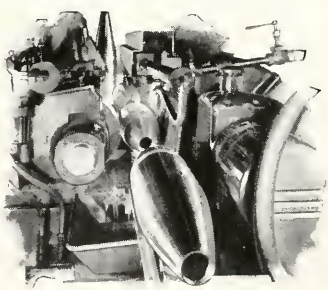
Spark Protractor

This accessory testing appliance is double insulated, permitting the high tension current to jump across a revolving gap of 0.010 in. The gap is in synchronism with the crank pin and has an eight inch protractor, which permits observations to half degrees of spark advance. When used with some conventional engines it was found that some "stock" spark-advances "floated" as much as 10 degrees, due to lost motion in the distributor drives. Our practice for spark advance anti-knock testing of fuels some years ago dictated a more rigorously maintained spark advance. This was accomplished by putting the breaker mechanism directly on the crankshaft of the engine and using the conventional distributor. Variations

(Continued to page 50)

The shell that brings 'em back alive-

What makes a Nazi surrender? Sometimes it's a "prisoner passport" delivered in a propaganda shell, compliments of the U. S. Artillery. Today industry is turning out all types of shells faster than anybody ever dreamed. Certainly Carborundum takes great satisfaction from the big part its products play in this vital war job! Nowadays shells big and little pour out of centerless grinding machines like this in a never ending stream.



Abrasives by Carborundum also keep tools sharp, and finish metal, wood and plastics. Super Refractories by Carborundum line high temperature furnaces and help solve the problems of the process and chemical industries. "Globar" electric heating elements increase the efficiency of high temperature heat treating furnaces, ceramic kilns, etc. This wide industrial coverage offers exceptional opportunities for Engineer-salesmen. If interested, please write The Carborundum Company, Niagara Falls, New York.

PRODUCTS BY

CARBORUNDUM

HELP YOU MAKE THINGS BETTER
IN INDUSTRY, AGRICULTURE, ARTS AND CRAFTS

(Carborundum and Globar are registered trade marks of and indicate manufacture by The Carborundum Company

AUTOMOTIVE LAB

(Continued from page 48)

are then of the order of less than one degree.

Model Wind Tunnel

There has been built recently a model wind tunnel, having a two-range throat, the larger being 22″ x 22″ with air speeds up to 60 mph. In this wind tunnel, the streamlining may be studied by smoke pattern also, the drag and lift characteristics of model airfoil sections may be experimentally determined. This wind tunnel has a hydraulic balance which was recently designed and constructed in our own shops. This balance measures by means of a hydraulic-mechanical network so that the data is indicated on four manometers. This balance has given satisfactory results for lift and drag measurements and is in the developmental stage with regard to further refinements.

The force indications up to 120 mph. on airfoils 2½″ by 15″ long are at present measured on four water columns which may be set vertically or inclined. These water columns are disposed with reference to the horizontal plane of the air flow at four 90 degree positions, designated as North, East, West, and South. The balance is referred to as the "NEWS" balance.

A larger wind tunnel at Illinois Institute of Technology is in another department under special assignments at this time.

Micro Wind Tunnel

A small, rounded entrance nozzle for a straight section of 2.345″ in diameter is provided with suitable means for obtaining air flows at 10, 20, and 40 mph. The measurements of drag only are made with this unit at present. Models have the form of flat plates, spheres, half-spheres, conical sections, and other appropriate forms. Means are provided for measuring the drag to closer than 1/4000 of a pound. This set-up permits experience with air flows and computations of drag coefficients of various shapes. (See Fig. 6 front.)

A No. 2 micro wind tunnel is also provided, very similar to the above described tunnel, with air speeds up to 145 mph. Models in this case are mounted upon an arrangement permitting drag coefficients to be "weighed" for various model shapes. (See Fig. 6 rear.) A further small unit permits the demonstration of air velocity measurements and ram studies at 270 mph.

Accelerometers

Wind resistance inspection may also be made with accelerometers in road or rail vehicles. The laboratory has two horizontal-column accelerometers having vertical liquid indicating scales of about 2 inches per foot per second. This scale is sensitive enough to measure the drift or rolling resistance of an automobile to within about 5 lbs. The bubble accelerometers have a double range scale, one for direct drive up to 5 ft. per second and the other to one "g" or 32.17 ft. per second for four-wheel braking. These instruments are used for car road performance demonstrations with students. An item of interest is the computed tractive effort, or, more especially of interest today, the tire reaction on the road surface.

Specialized Items

Four other items of engineering interest have been given attention and frequently are the subject of witness demonstrations or especially assigned problems. In most cases only limited treatment can be given for undergraduate work.

Critical Speeds—Whirling and Torsional.

There are many instances in a machine when a piece of shafting will develop a whirling critical condition due to the sag of the shaft and the resultant displacement. This results in compression of one side and tension in another. When the shaft is rotated, these stresses are reversed in the elastic medium and they result in resonance conditions at certain speeds. The accompanying chart, Fig. 7 shows the whirling critical speeds for any shaft from 1″ to 16″ in diameter and over a wide range of spans, some of which are theoretical only. It shows direct readings for a hollow shaft with 0.1 in. wall or a solid shaft, or interpolated readings for other wall thicknesses, and has been very convenient to use. It was made up to facilitate and/or check computations when a specific problem in test-cell operation was encountered. Copies of this chart (11″ x 17″) will be mailed upon written request to the Illinois Tech Engineer and Alumnus.

Torsional Criticals:

This problem is only casually treated in undergraduate work in this laboratory because of its magnitude. Its importance, however, always warrants an outline of the major factors and usually permits a classroom presentation of the critical torsional speed computations for a radial single-row aircraft engine, since this construction is the simplest typical case. Some special experimental work is being done on steel damping effects.

Torque Wrench Studies:

The practice of applying a specific load on bolts and nuts in machinery is of extreme importance, particularly when machines are of such nature as the very light-weight aircraft engines. In many other instances, also, the proper loading of cylinder-head bolts, spark plugs, and other screwed fittings is of great importance. For the purpose of demonstrating the loading and torque wrench practice, an alloy-steel bolt ½″ in diameter and 5″ long, is used. The length of this bolt is measured before and after a definite torque loading. Efficiency may vary from 6% to 20% and indicates the need of knowing the installation conditions when specifying torque wrench loadings. The better way, of course, is to use the stretch of the bolt if this can be measured in practice. The stretch of the bolt for this experiment is either measured with an outside micrometer or in a special fixture, using a dial indicator, reading to 0.0001 inches. (See Fig. 8)

$$\text{Total bolt load by stretch} = \frac{\text{Et} \times \text{area bolt} \times \text{total ext.}}{\text{total length}} \quad (1)$$

$$\text{Total bolt load} = 2 \times \pi \times 12 \times \text{T} \times \frac{1}{\text{pitch}} \quad (2)$$

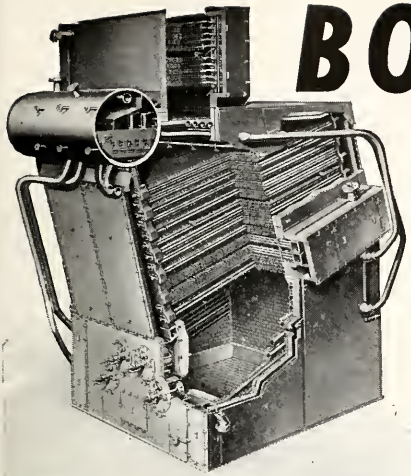
$$\text{Efficiency} = \frac{(1)}{(2)} \quad (3)$$

Polarizer:

An emergency study of the location of the most highly stressed point of the joint between the cylinder barrel and the head of an aircraft engine made it advisable to see a sample section of this in polarized light. A polarizer was made up for this purpose and since then has been used on various occasions. This study is somewhat out of the province of this laboratory and, therefore, the polarizer is used more by the mechanics department and others, where it supplements their more elaborate instruments.

Propeller Tests:

The laboratory has a small versatile propeller testing equipment, permitting experimental verification of laws relating the torque and h.p. to the speed of propellers up to four feet in diameter. The electric cradle dynamometer is mounted on a special ball bearing frame permitting thrust measurements by the pendulum method. This equipment is sensitive to less than 1/100 h.p. and used for static as compared to flight conditions.



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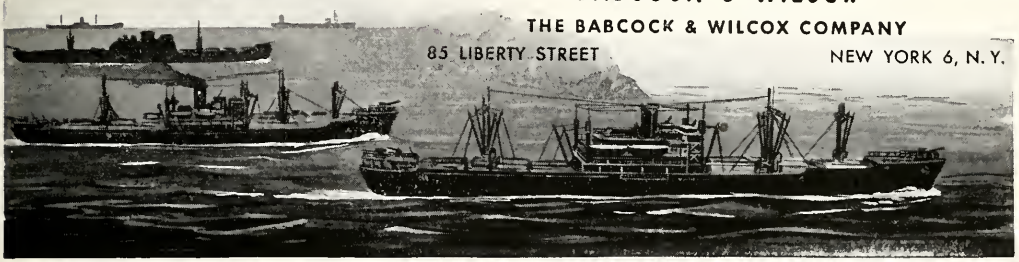

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THOMPSON

(Continued from page 46)

the Kaiserhof hotel, I was convinced that I was meeting the future dictator of Germany. In less than fifty seconds I was quite sure I was not. It took just about that time to measure the insignificance of this man who has set the world agog. He is formless, almost faceless, a man whose countenance is a caricature, a man whose framework seems cartillaginous, without bones. He is inconsequent and voluble, ill-poised, insecure. He is the very prototype of a little man."

She was right, however, if by "Little Man" she meant the opinion that the Allies now hold of Hitler. She apparently believed that the German people had better sense than to permit Hitler to be dictator, and she diagnosed Schicklegruber in less than a minute while the Germans have required several years to reach the same opinion.

Many humorous incidents have been recorded about Dorothy. In a town called Friendship, New York, she was assigned the job of spreading the gospel for woman suffrage. Apparently the town dignitaries thought that they would have a little fun. In those days there were many citizens against the "petticoat vote." So when she was introduced the band immediately began to play loudly leaving her to face a laughing, jeering crowd. She appealed to the assembly for a fair hearing but the band leader put on more steam. She spied a child's blackboard mounted on an easel across the street and bought it for $1.00. Setting it up she started to write her speech, piecemeal. The band leader eventually realized that he was up against a girl with determination and he stopped the band. Then she went on with her speech.

The German-American bund was holding a meeting in New York at which Hitler was being puffed up as a savior of the universe. She almost caused a riot by heckling the speaker and seemingly enjoyed being escorted out by a protective detail of police.

Father Coughlin, of the "Shrine of the Little Flower" fame, once referred to her as "Dottie," so when she wrote of him thereafter she always called him "Chuck."

When the American Woman's association suggested a "Dorothy Thompson for President Club," Sinclair Lewis made a remark that has since become classic: "I wish they would elect Dorothy: then I could write 'My Day'." Hugh Johnson called her the "No. I United States Breast-beater." Sir Willmott Lewis says that she "has discovered the secret of perpetual emotion."

Dorothy Thompson got started as a big-time columnist somewhat as follows: The New York Herald Tribune hired her to present to women such current happenings as women might be expected to understand. Miss Thompson surprised everybody, including her employer and herself, by turning out a column that was sensationally informative. Her column quickly spread through the states and is now syndicated by many papers. It is written in *Time* that "She appealed to women because she wrote like a woman. She appealed to men because for a woman she seemed surprisingly intelligent."

She is known as a "liberal of good will." Her social understanding is largely information gathered by an extraordinarily absorbent mind through years of association with social problems. A clubwoman's woman, she writes a monthly editorial for the *Ladies Home Journal*. She broadcasts weekly and lectures occasionally. Each day she receives from three to six invitations to speak.

Dorothy Thompson is one of the very few women with the nerve even to try to be a political commentator. It is believed that more men read her column than women. She remains thoroughly feminine in reserving the right to change her mind. She deplores some of the New Deal but approves wide scale planning on strict non-political basis. She approves sound private ownership. *Current Biography* writes of her: " 'Old style capitalism,' she says, 'is doomed,'; but her capitalist friends do not mind her saying so, they know at heart she is a conservative." Again, "The current war is just one manifestation of a world revolution going on for some time."

Dorothy emphasizes not so much the current events as the personalities behind them. Occasionally she exchanges verbal punches with Representative Clare Booth Luce. She hates Nazism, Fascism and Hitler. Sinclair Lewis once remarked, so they say, that if he ever got a divorce he would name Hitler correspondent. Whether or not this was the reason, they were divorced, and she married Maxim Kopf, the artist, in June, 1943. He recently exhibited his paintings in a New York gallery and received very favorable comment on them.

Dorothy Thompson has received honorary degrees from Russell Sage, Syracuse, St. Lawrence, Tufts, Dartmouth, Columbia, Oberlin and McGill University, Toronto. She has a dozen medals and special awards for achievements and was the only woman ever to address the Union League Club (New York), National Association of Manufacturers and U. S. Chamber of Commerce.

Mrs. Maxim Kopf (nee Thompson) lists her home at Twin Farms, South Pomfret, Vermont. She is interested in problems concerning farming and is the founder of the Voluntary Land Corps, an organization of young people to work on the farm. She is a member of the Patrons of Husbandry. She is a member of the American Academy of Political and Social Sciences, Phi Beta Kappa, Cosmopolitan and Town Hall clubs.

Her literary genius was early recognized. In the "Lewis Annual for 1912" there appears a translation of the Horatian Ode IX (To Thaliarchus) from the Latin to English in the original meter. If one tries he will find that it is not very easy to do. The second stanza reads as follows:

"Hence with cold! Build high the hearth
For youth is thine.
We must laughter have, and mirth,
Life, jest and song, with never dearth
Of Sabine wine!"

Here's to, Dorothy Thompson—a champion of civil liberties and peace among men and nations. It is an honor to add her name to the roll of graduates of distinction of the Illinois Institute of Technology.

When the National Electronics Conference met in Chicago, representatives of 38 states, the District of Columbia, and four foreign countries attended, totaling 2193 persons.

Illinois headed the attendance list since almost half the conference members were residents of the state. But interest in the meeting was not merely local. Second in line was New York with 185, closely followed by Ohio's 137. Massachusetts' members also numbered in three numerals, 102.

When the roll was called, answers were voiced by people from states in every section of the nation. Washington, Texas, Wyoming, Utah, and Colorado, represented the far West, while Virginia, North Carolina, Alabama, Georgia, Louisiana, Kentucky, and Florida had members here from the South. Every middle Western state was listed in the attendance book, while only a few of the Eastern and New England states were omitted.

The delegates from Canada, France, Russia and Argentina proved the international importance of the National Electronics Conference, and they will carry its results worldwide.

JET PROPULSION

(Continued from page 12)

present state of development, its overall efficiency is considerably below that of a conventional engine-propeller combination. Its future is bright, however, and the one American plane now employing it, the Bell P-59A Airacomet, is said to be "the fastest ever flown."

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(Editor's note.—Mr. Yellott's article will be concluded in an early issue of this magazine.)

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TRUSTEES

(Continued from page 16)

as an assistant professor, following military service in the last war.

Born in Chicago, February 27, 1897, he became electrical engineer at the Metallurgical corporation in North Chicago after he left Armour Institute. He was then vice-president and general manager of the Ramet Corp. As a partner in the McKinsey Kearney Co., Chicago, Mr. Stryker was in charge of all activities relating to manufacturing and engineering from 1936 to 1940. Since 1940 he has been vice-president and assistant to the president of the Nordberg Manufacturing Co. of Milwaukee, Wis.

In 1944 he received the Armour Alumni Service Award. He is a fellow of the American Institute of American Engineers, a member of the Newcomen Society, the Society of Naval Engineers, Eta Kappa Nu, and Theta Chi. In Milwaukee he belongs to the University Club, the Milwaukee Club, and the Milwaukee Country Club.

The former director of the Armour Research Foundation, HAROLD VAGTBORG is now president of the Midwest Research Institute, Kansas City. He was affiliated with the Illinois Institute of Technology from 1931 to 1944. For seven years he was professor of municipal and sanitary engineering at Armour Institute. While he was director of the Foundation he was also founder and director of the Gas Institute, a position he held for two years. This year he was elected to membership in the National Research Council.

Born in Copenhagen, Denmark, in 1904, Vagtborg came to the United States in 1906. He received his Bachelor of Science degree from the University of Illinois, and his M.S. from the Armour Institute of Technology. Before coming to Illinois Tech, he was superintendent of construction for Vagtborg Construction.

He belongs to the American Society of Civil Engineers, the American Chemical Society, the American Physical Society, the Western Society of Engineers, the Illinois Society of Engineers, the Chicago Engineers Club, and the University Club.

NEW STAFF MEMBERS

(Continued from page 19)

of Technology, Berlin-Charlottenburg, and the Swiss Federal Institute of Technology, Zurich. In addition to his academic training he has had experience at Combustion Engineering, New York and DeLaval Steam Turbine company, Trenton, N. J.

WITOLD STOPOWY was graduated from the Technical University of Lwow, Poland, in 1930. After having done research in Poland and Canada, he is associate chemical engineer at Gas Institute.

ELEANOR LANDON AND MASANDBO MIYAJI are new junior chemists. After taking her bachelor of science degree at Mundelein college, Miss Landon received her M.S. at the University of Illinois in 1943. She has been research assistant in analytical chemistry at the American Meat Institute. Miyaji was graduated from Illinois Tech in 1944.

THOMAS KENNY, a 1943 chemical engineering graduate of Illinois Tech, is assistant chemical engineer. Until recently he held that position at the Gates Rubber company.

MIDWEST

(Continued from page 40)

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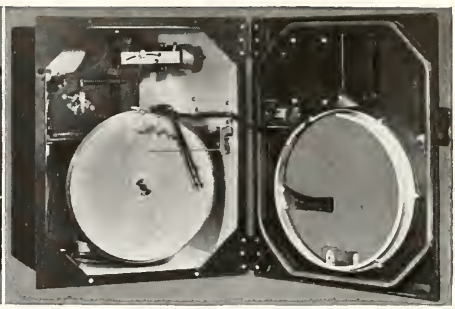

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The air flow element consists of an oil sealed bell in a sealed chamber. The motion of the bell is transmitted through a diaphragm seal. This arrangement permits the use of a single bell—the high pressure being applied to the top of the bell and the low pressure under the bell. This arrangement also excludes air and dirt from the oil. The motion of the bell is transmitted to a cam system which extracts the square root, or when adjusted for a particular installation, compensates for chimney action and variable excess air requirements. The air flow pen is attached to the cam system with an adjustable linkage which permits changing the steam flow air flow ratio as conditions may require.

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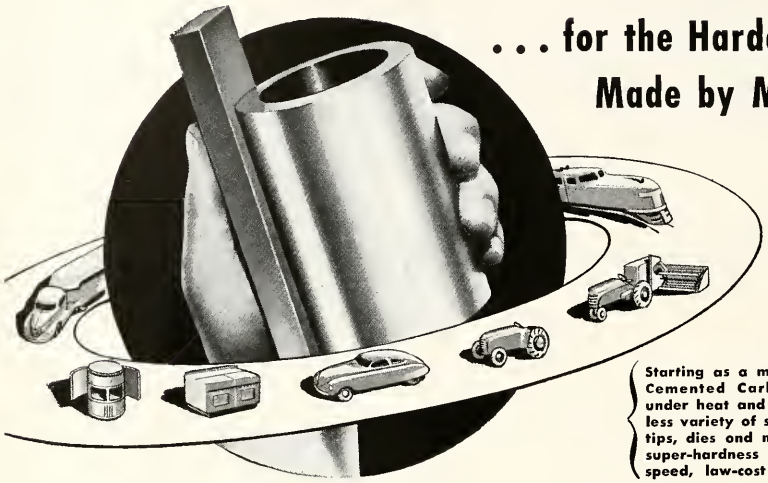

Starting as a metal powder, Carboloy Cemented Carbide is transformed, under heat and pressure, into an endless variety of shapes and forms—tool tips, dies and machine parts with the super-hardness that is vital to high-speed, low-cost industrial production.

STRAIGHT through industry, after the war, there will be jobs that only the "hardest metal made by man" can handle.

Why? Because the cry is for better, longer lasting products and parts. Because closer tolerances will be combined with mass production.

And because industry knows that postwar profits will depend largely on the cost at which goods of top quality can be produced in top volume.

Work No Other Known Metal Can Do

Urgent war production needs brought Carboloy Cemented Carbide into its own. Its *super-hardness* was needed in tools to machine *super-tough* alloys — in dies to draw wire and tubing and to form sheet metal.

Carboloy Cemented Carbide works at speeds once thought impossibly high, to tolerances never before practical in mass production—and it commonly doubles or triples the output of machines and men.

It is a matter of war record that the use of this magic metal made possible production of three times the number of aircraft engine crankcases and gears with the same equipment and manpower. And this is only one of many examples.

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A "Must" in Tomorrow's Competitive Race

The hardest metal made by man may well write the price tags in tomorrow's "battle of costs." You are invited to take full advantage of Carboloy engineering, facilities and experience in planning products for tomorrow.

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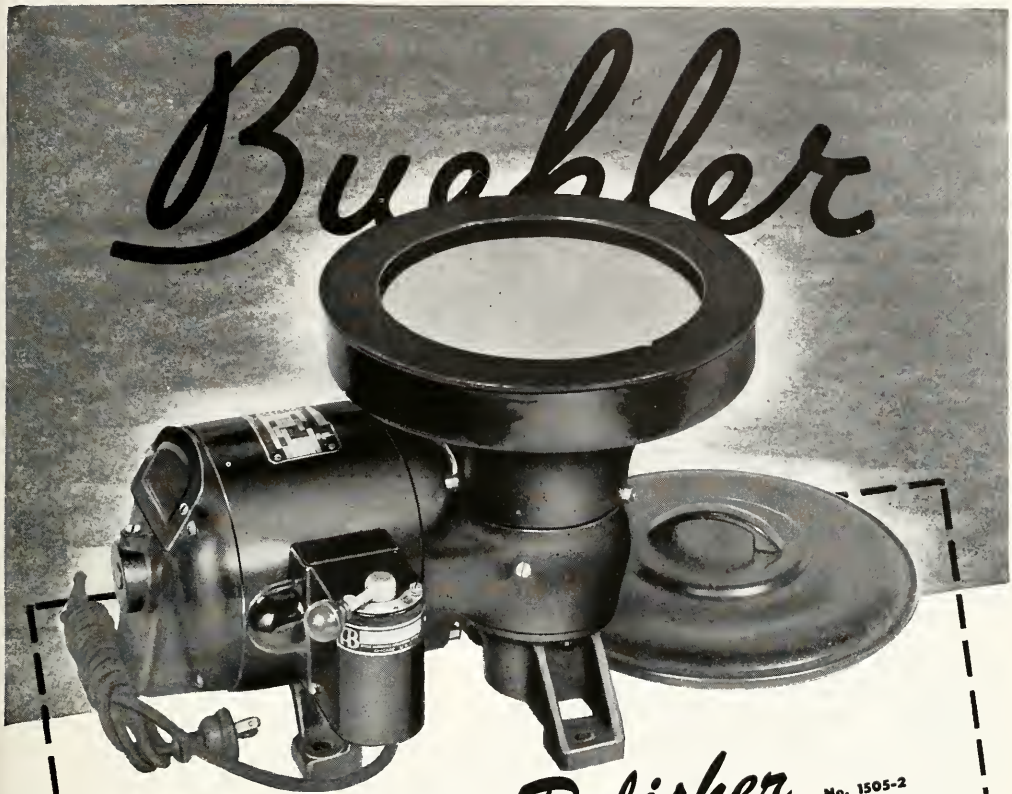
THE HARDEST METAL MADE BY MAN



Low Speed Polisher No. 1505-2

. . for accurate final polishing

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Low speed polishing is increasingly popular for the final step, particularly where soft non-ferrous metals are encountered. The production of smooth polished samples with a minimum of surface scratches and disturbed metal is the outstanding feature of this low speed Buehler Polisher No. 1505-2. Built to operate at selective speeds of 150 r.p.m. and 250 r.p.m. through a positive gear head drive housed in an oiltight base, this polisher represents the highest development in equipment for precision finishing of specimens. This polisher is also perfectly suited to the wax lap or lead lap polishing technique preferred by many metallurgists.

The 8" diameter polishing disc is attached to a countershaft by a tapered sleeve. This tapered fit and long span between bearings assures smooth operation. The motor is ¼ h.p. single phase ball bearing, operating on 110 V., 60 Cycle AC current. Shipping weight, 80 lbs.

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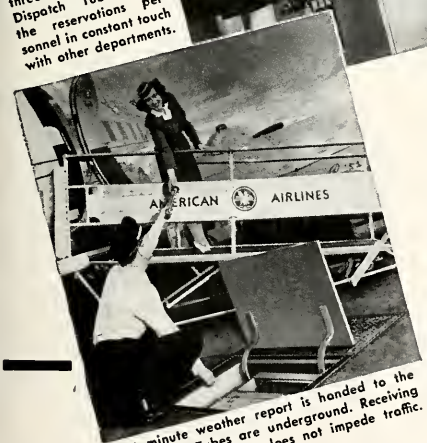

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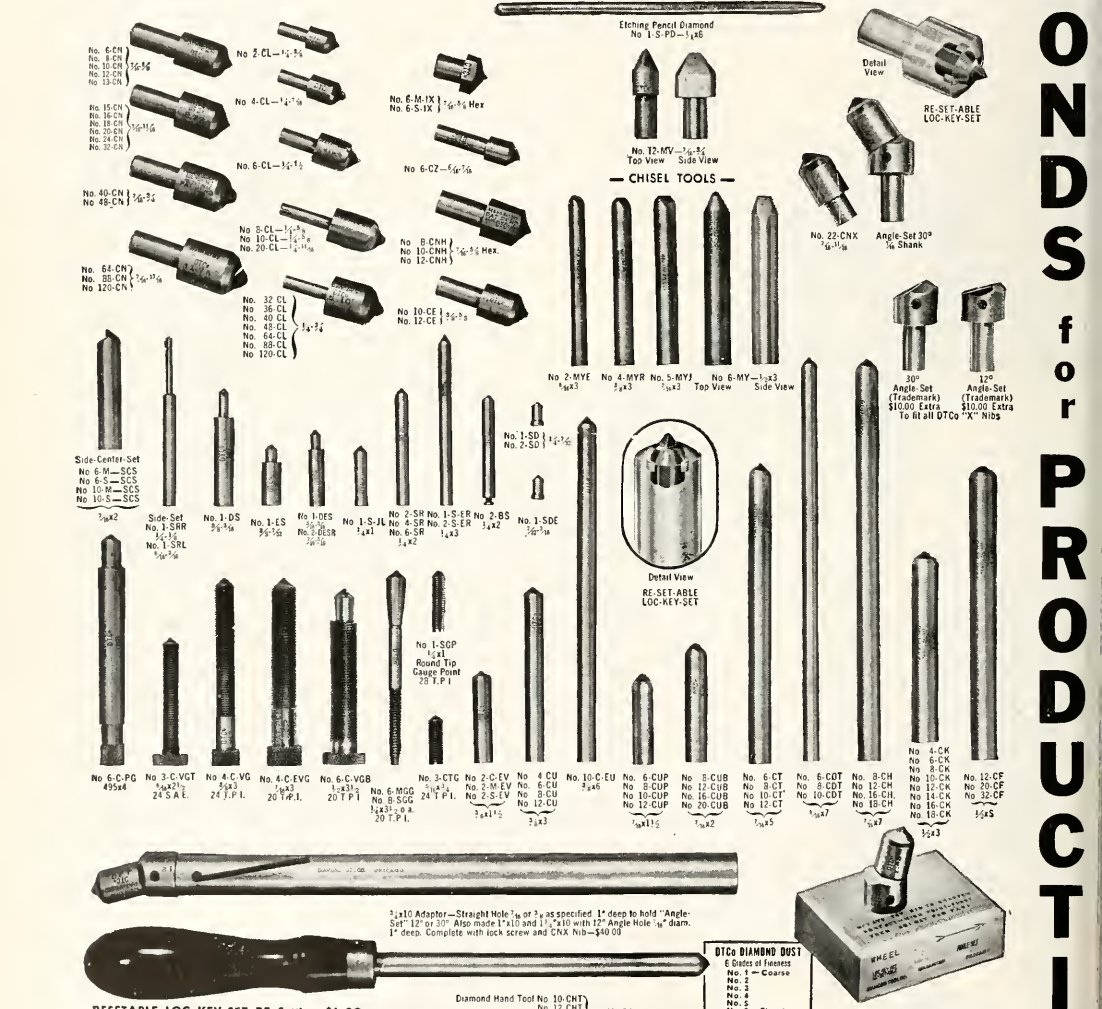

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INSTRUCTIONS FOR ORDERING: Number of each tool pictured is eight times the diamond size contained in tool, and is two times the diameter of grinding wheel each tool is suited for. Example—For ½ carat number of tool is 4, and it is suitable for 2-inch wheel; for 3 carats number is 24, suitable for 12-inch wheel. NOTE: Above recommended sizes are for heavy production and include an added 50% safety allowance. For light work add ½ diameter to recommended wheel size. Diamond weights are stamped on all tools where space permits. Form Tool Diamonds: Special tools made from customers' prints and specifications. Reprints of this presentation furnished on request.

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DIAMONDS for PRODUCTION

"When Day's Work Is Done" painted by Rudolf Wetterau

Home

Peace. Privacy. Your own domain, where you are "boss." Where you can do as you please, when you please and how you please.

It won't be long now—that's what we're working and fighting for.

And when the work is done, there are plenty of things you'll find unchanged at home—one of them is Kaywoodie, the pipe most men have adopted as the best in the world. It'll be the same mild, cool, flavorful smoke, made of the same fine Mediterranean briar, as before the war, or long ago.

Kaywoodie briar is a natural product. Time, and the sun and soil and wind produce it, and they're not in a hurry. Our seasoning of it isn't hurried, either. It takes years to make a Kaywoodie.

These stout pipes are tempered with special curing-agents, so that they transform tobacco into the most delicious, fragrant, satisfactory smoke you ever tasted. We promise you thoroughly agreeable enjoyment, and we believe you'll find Kaywoodie-smoking one of the best, most satisfactory experiences in life.

Many Kaywoodies go direct to our fighting men — please be patient if your dealer temporarily can't supply you. Illustrated here is Meerschaum-Lined Kaywoodie "Squore" Shape, No. 11C — $12.50.

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ILLINOIS TECH ENGINEER

AND ALUMNUS

March, 1945

Looking Across Twenty-Five Years

Twenty-five years of impressive growth and progress are reflected in these lake-front scenes of Chicago in 1920 and in 1945. The contrast emphasizes the sweeping changes this swift-moving quarter of a century has brought—not only to urban America but to business and industrial America as well.

In 1920, Witco Chemical Company was a small organization with a single office in Chicago. Today it is an important factor in America's expanding chemical industry, serving manufacturers of rubber, paints, printing inks and many other products from branch offices in leading cities throughout this country, and from London. And Witco's list of chemicals, pigments, asphalts and other materials is constantly increasing to meet the accelerated demands of war.

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Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

REMOTE CONTROL

HE'S a gunner on a Boeing Superfortress. And there's a Jap plane framed in his sight. As he swings around, tracking the Jap, the low steel-lidded turret—which may be yards away—also turns. It follows his movements, and the guns raise and lower. And by pressing a button under his thumb, he can fire a fatal barrage.

But those guns don't point where he's aiming. For tied in between him and the guns is the G-E electronic-mechanical computer. It makes corrections for lead, windage, distance, parallax.

By flicking a switch, he can take over the control of up to three turrets. That leaves the B-29 protected on all sides—no blind spots for enemy attack!

NO SALE

THIS satisfied television set owner—one of several hundred envied people in the Schenectady-Albany-Troy area—hangs on to his receiver in spite of heavy demands for used sets. He enjoys the programs telecast from the G-E station, WRGB, and looks forward to even better entertainment after the war.

When postwar sets are made available, their owners will enjoy a diversity of programs. The picture of probable television developments, drawn by G-E engineers, shows interesting changes. There will be television wireless networks, made possible by the G-E "lighthouse tube," which utilizes ultra-high frequency radio beams for sending programs from one point to another. And then there will be smaller stations—known as satellites—to carry programs from centrally located master stations to the folks down on the farm.

CATCHING SNOWFLAKES

"FOSSILIZING" snowflakes is a fascinating hobby for Vincent Schaefer of the G-E Research Laboratory. But more than that, it's part of a critical war program. His technique for making replicas of snowflakes can be applied to other things, like metals needed for analysis.

It would be possible to get pictures of metal surfaces with a powerful electron microscope, except for one problem. The electron microscope relies on having a stream of electrons pass through the sample, and no way has been found to make a slice of metal thin enough to be transparent to an electron stream.

Thanks to Mr. Schaefer's innovation a very thin plastic reproduction of the metal is used. That's placed under the electron microscope, and then the analyst gets to work. *General Electric Company, Schenectady 5, New York.*

Hear the G-E radio programs: "The G-E All-girl Orchestra," Sunday 10 p.m. EWT, NBC—"The World Today" news, Monday through Friday, 6:45 p.m. EWT, CBS—"The G-E House Party," Monday through Friday 4:00 p.m. EWT, CBS.

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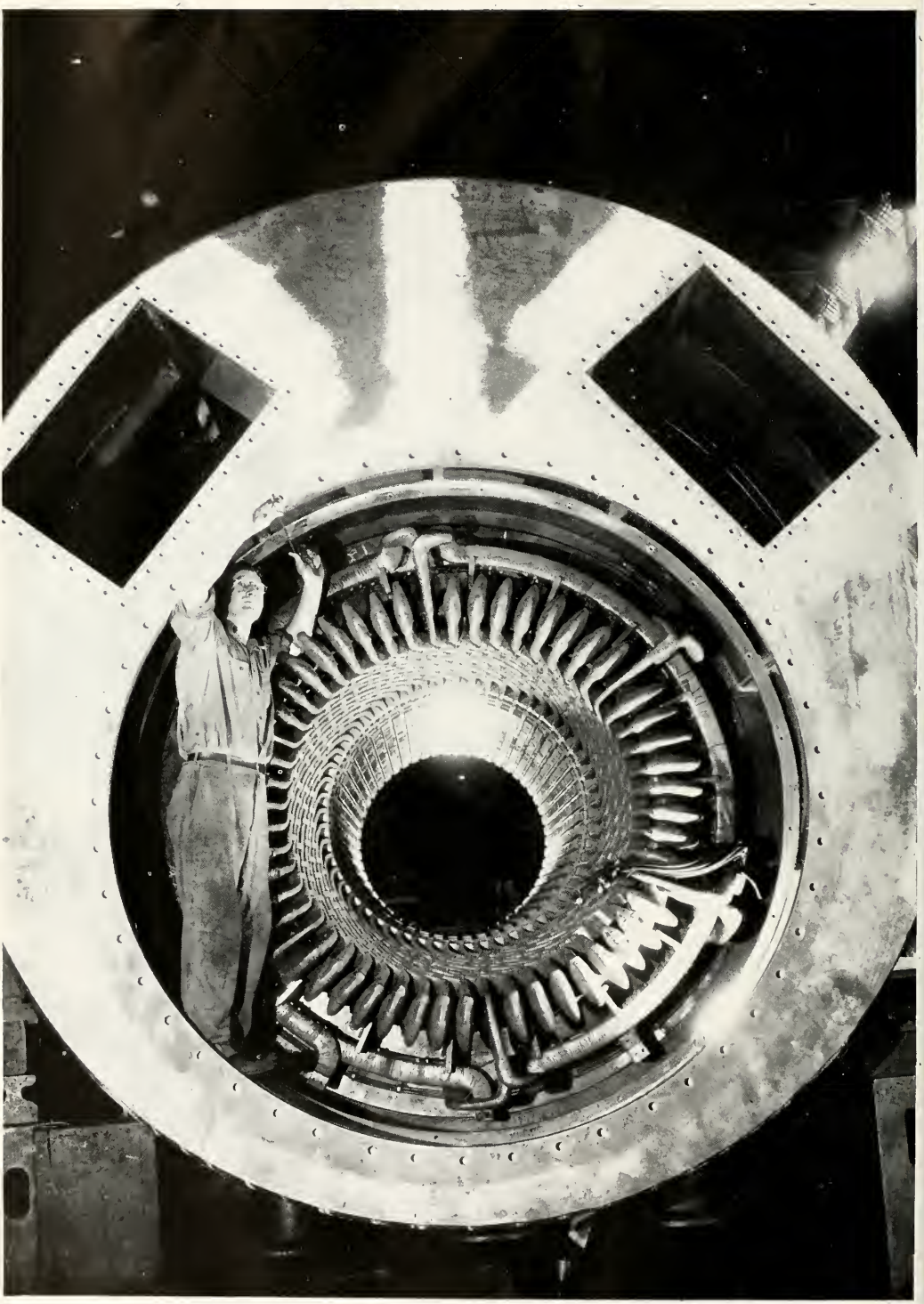

PLAY ON A ONE-STRING HARP? It would be like trying to make truly great beer from a single brewing. That's why the Pabst Blue Ribbon process of *full-flavor blending* combines never less than 33 fine brews, to insure the even goodness and depth of flavor that sets this famous beer apart. Order it with confidence, serve it with pride—for there is no finer beer than Pabst Blue Ribbon.

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WITH HARRY JAMES AND HIS MUSIC MAKERS

MARCH 1945

ILLINOIS TECH ENGINEER AND ALUMNUS

VOLUME 10 NUMBER 3

IN THIS ISSUE

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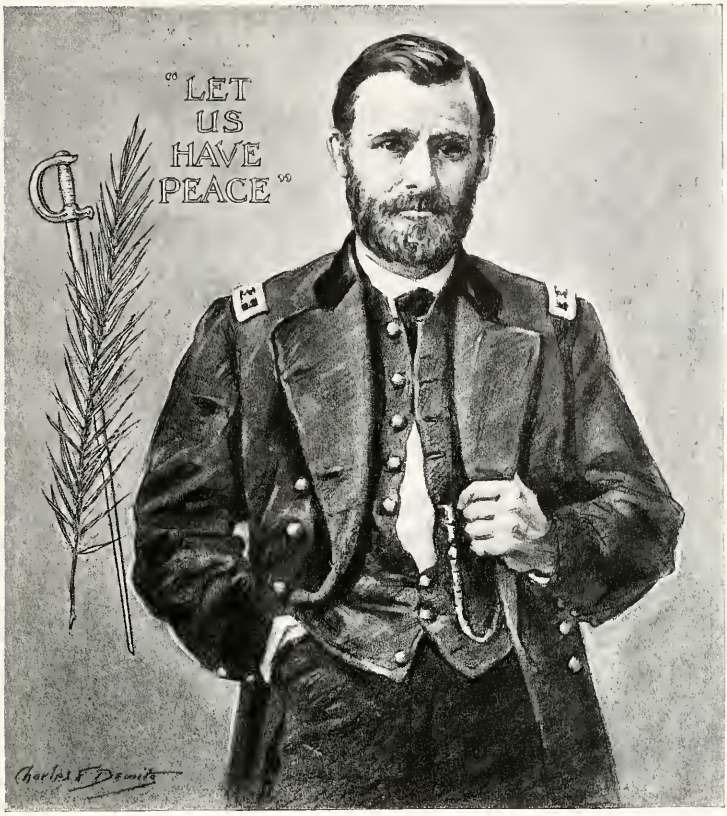
ULYSSES S. GRANT — 1822-1885



"Grant came of the old self-contained stock, men of a simple force of being, which allied his genius to the great elemental forces of Nature—silent, invisible, irresistible,"—in this we may see the real essence and source of his extraordinary moving force.

In his last hours he wrote:—"I am glad that, while there is unblushing wickedness in the world, there is compensating grandeur of soul."

We have looked into the heart and soul of Ulysses Grant and can understand why he uttered those words,—"Let us have Peace."

Not—The truce of the crushed,

Nor—The peace of the strong.

But—The peace of weak and strong

Wide as the sky above,

The peace of love.

William Kent.

Croname Incorporated ● Chicago

Contributors

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Cover—A rubber saw is shown cutting an iron pipe in the laboratories of the Armour Research Foundation of Illinois Institute of Technology.

Frontispiece—Electric power to help boost the nation's output of synthetic rubber will flow soon from this turbo-generator being built at the East Pittsburgh Works of the Westinghouse Manufacturing Company for a big rubber making plant. Driven by a steam turbine, the rotor of this 138-ton giant will spin around 3,600 times a minute to supply 35 million watts of electric power. The generator is cooled by hydrogen which is blown by fans within the circular frame shown.

All Napoleon needed was *one* spotter plane...

Napoleon was a hot shot artilleryman! His cannoneers had hairy ears... but better reconnaissance would have saved his bacon . . . and his empire!

One little "Spotter Plane" might have changed the face of Europe . . . and our destiny.

Every ingredient of the spotter plane that Napoleon needed was on earth then. The only reason the plane itself didn't exist was because men had not learned to "Imagineer" the things they needed.

"Imagineering" is a word we invented to describe the way Alcoa, and other great groups of technical men and women, go about the job of supplying the materials, methods and machines of modern life.

Remember this word "Imagineering". It represents the union of imagination, man's oldest mental development, and engineering, his newest. Together they are the key to progress. Together they are the engineer's contribution to mankind.

ALUMINUM COMPANY OF AMERICA, Gulf Bldg., Pittsburgh 19, Pa.

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We believe there is no substitute providing to so full an extent, the advantages that ball bearings give in so many applications—particularly when made with the technical experience that goes into New Departure Ball Bearings.

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JET PROPULSION

The Second of Two Parts

By

JOHN I. YELLOTT

The most spectacular military application of the rocket principle is unquestionably the Nazi V-2, which first began to rain down upon England in the late summer of 1944. This device, characterized by super-acoustic speed, has not achieved the destructiveness which its inventors anticipated, primarily because its excessively great velocity causes it to bury its lethal nose so deeply in the ground that the resulting explosion resembles a minor earthquake, rather than the more destructive blast of a shell or bomb of equivalent weight. V-2, apparently an excessively ingenious German development of the earlier American rocket experiments of Dr. Goddard, has not yet been captured intact, but army intelligence reports have given quite a complete picture of its construction and method of operation.

The stratosphere rocket is undoubtedly the largest projectile yet to be developed by the misguided ingenuity of Teutonic engineers. A true rocket, V-2 is powered by a jet from a combustion chamber to which oxygen and alcohol are supplied. Descriptions issued by the British Air Ministry news service tell us that, as shown in Fig. 6, this flying torpedo carries a relatively small warhead provided with about 2,000 pounds of high explosives. Liquid oxygen and alcohol are carried in fuel tanks located amidships which contain about 7,500 pounds of alcohol and 11,000 pounds of oxygen. A turbine, located just behind the oxygen tank, is driven by superheated steam produced by mixing hydrogen peroxide with calcium permanganate, and this turbine drives the pumps which force the liquid oxygen and the alcohol into the combustion chamber.

Electrical ignition, remotely controlled from the launching platform, starts the combustion and the alcohol-oxygen mixture subsequently continues to burn violently. The products of this combustion flow from the orifice at the rear as an extremely high-speed jet of terrifically hot gas. The initial thrust is approximately 26 tons, and the path of the projectile as it leaves the launching platform is almost vertical. Gyroscopic devices, located just behind the warhead, operate the control surfaces, and cause the rocket to curve from the vertical towards the target. The range of the rocket is controlled by pre-setting an automatic fuel cutoff. By controlling the length of time during which the fuel burns, the height of the trajectory can be determined, and thus the range is calculated in much the same manner that the student in sophomore mathematics determines the course of his mythical projectile which flies along a parabolic path through resistance-less space.

V-2, because of its tremendous starting thrust, reaches a speed of about 3,000 miles per hour and accordingly passes through the earth's atmosphere and into virtually empty space in the few seconds which elapse before the fuel is exhausted. Since the rocket is pointing upwards at about 45 degrees when the fuel is cut off, it continues

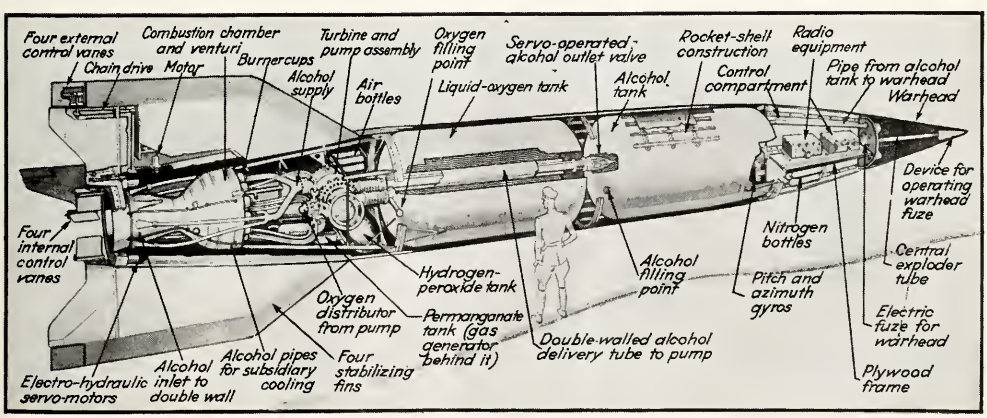


Fig. 6. Vergeltungswaffe 2—Death from the Stratosphere
(Illustration from POWER, Feb., 1945)

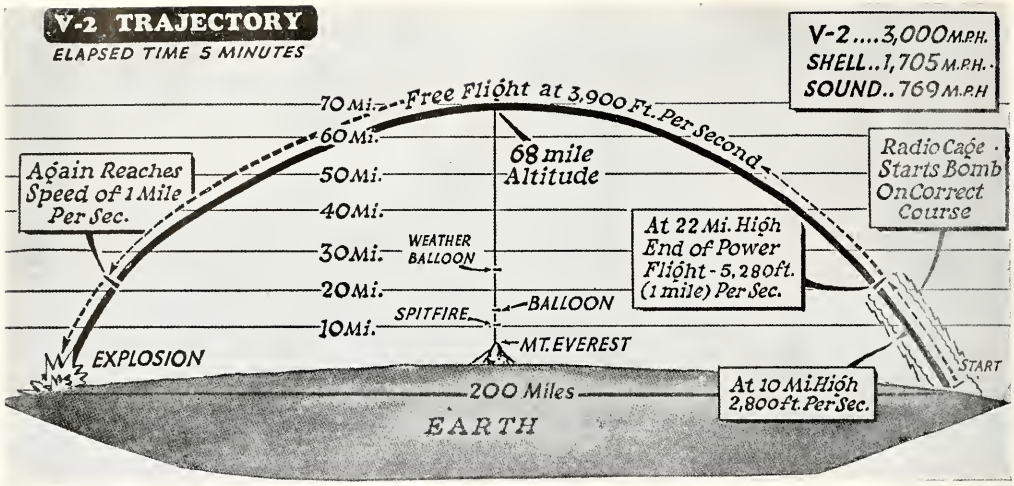


Fig. 7. The Trajectory of V-2 (Chicago Sun)

along its parabolic trajectory achieving a maximum altitude of approximately 68 miles, Fig. 7, and then, under the influence of gravity, it rushes towards the earth at a speed which may exceed one mile per second. Since sound travels at a speed of about 770 miles per hour at sea level, the V-2 obviously precedes its own sound waves. It traverses its entire course, some 200 ground miles, in approximately five minutes. As the rocket descends through the atmosphere from its maximum elevation it is slowed down to about 2,000 miles per hour by the resistance of the air and at the same time it is heated in much the same manner as a meteorite which enters the earth's atmosphere. Observers who have survived the arrival of V-2 in their immediate vicinity have noted that it appears to glow dull red.

The present military value of V-2 is questionable, since it cannot be aimed with any degree of accuracy and it carries only half as much weight of explosives as a moderately large block buster. Likewise, it must inevitably consume a very large number of man-days of labor in its construction, and allied military authorities feel that an equivalent amount of effort would be more effective if devoted to either V-1 or a conventional bombing plane.

In endeavoring to foresee the future of this type of weapon, one must admit the possibility of increasing its range tenfold so that a rocket, launched from some secret spot in Europe, could conceivably reach America. The laws of probability dictate that the chance of a single missile doing any serious damage is extremely remote, but those skilled in the art of radio control can envision the possibility of directing such a weapon so that it would follow some remotely-controlled route to a vulnerable target. For World War II, it would appear that, just as in the case of V-1, the Germans were somewhat too little and too late with V-2, but, once again, this unexpected development provides convincing proof that only by eradicating war entirely can we eliminate the danger of such an attack.

The robot bomb, V-1, briefly mentioned in the first portion of this paper, is at present a much more dangerous weapon than its larger brother, the long-range rocket. The destruction which the Germans were able to wreak on London and the surrounding countryside gives proof that, despite the effective efforts made by the British to shoot down the robot bombs, or to trap them with barrage balloons, they might well have played a decisive part in the war if the Germans had been able to launch them earlier. Fortunately the channel coast was cleared of its infesting Nazis before they could launch enough robombs to do more than destroy a million British homes and kill some 6,000 victims, mainly civilians.

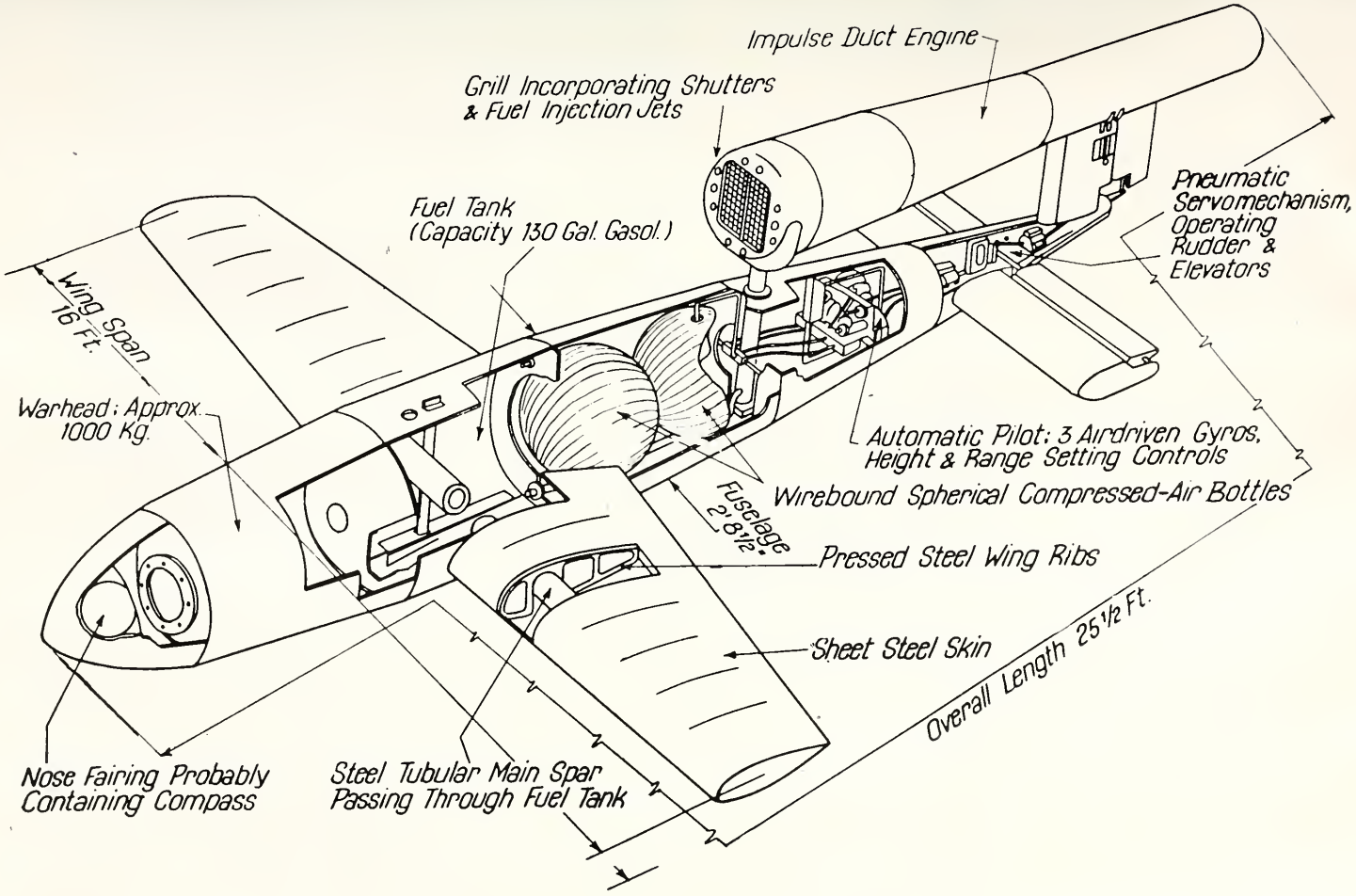
"It is generally agreed that London escaped complete destruction last summer by only a hair's breadth, that had the invasion not taken place when it did, the enemy installations in France would have sent across twenty-five hundred robots a day. This they were equipped to do. Even allowing for the admitted imprecision of aim, this would have meant the total extinction of the Capital," says S. N. Behrman, writing in The New Yorker.

The construction of the buzz-bomb has been explained by many publications, and the operating principle of its impulse duct motor has already been discussed. However, this device is so ingenious, and its military possibilities are so great, that a somewhat more detailed description is in order. Many of these weapons have been captured by the Allies and most of the construction details are now well known. Fig. 8 shows a phantom view of this bomb, with the shell cut away so that the interior can be studied. Just as in the case of V-2, the nose carries some 2,000 pounds of high explosives but it is fitted with a fuse which causes it to explode at ground level, causing terrific damage to buildings and human beings in its vicinity.

In construction, V-1 is a model of simplicity. Its wings are made of pressed sheet steel, carrying a loading of about 150 pounds per square foot. The importance of this factor will be mentioned later. An American engineer, accustomed to mass production in the automotive industry, estimates that the cost of these bombs in large quantities would not exceed $1,000, and Henry Ford would probably undertake to build them at a much lower cost. The wing spread is

(Continued on page 30)

Fig. 8. The Robot Bomb (Metals Progress)


Impulse Duct Engine
Grill Incorporating Shutters & Fuel Injection Jets
Fuel Tank (Capacity 130 Gal. Gasol.)
Pneumatic Servomechanism, Operating Rudder & Elevators
Wing Span 16 Ft.
Warhead: Approx. 1000 Kg.
Automatic Pilot: 3 Airdriven Gyros, Height & Range Setting Controls
Wirebound Spherical Compressed-Air Bottles
Fuselage 2' 8½"
Pressed Steel Wing Ribs
Sheet Steel Skin
Overall Length 25½ Ft.
Nose Fairing Probably Containing Compass
Steel Tubular Main Spar Passing Through Fuel Tank

ENGINEERING PREVIEW

A Partial Digest

ENGINEERING PREVIEW. NEW YORK: THE MACMILLAN COMPANY, 1945. Pp. x + 575. This outstanding addition to the writings in the field is the work of seven eminent educators of engineers who are here writing for the prospective candidate in their field. It appeared on the bookstands late in February. Four of the authors are faculty members of Illinois Institute of Technology. Dean Grinter, vice-president of the Institute, is the author of the chapter from which this digest is drawn.

There is an old saying that you can't make a silk purse from a sow's ear. It is quite as impracticable to make an engineer of a young man who should be a musician or a poet or perhaps a lawyer. Not that you may not become both an engineer and a musician or lawyer. But if you are to become an engineer, you must have most of the well-known qualities of an engineer, and then, if you also have other useful qualities, so much the better.

It is pretty well understood that a good engineer must be reasonably good in mathematics. Now that does not mean that every engineer is a "math whiz" by any means, but it does mean that, on the average, engineering students make about the same grades in their engineering subjects that they make in mathematics. I cannot say, however, that most engineers like to study mathematics. They are too impatient, too anxious "to study something practical," but they do stick to their mathematics courses and learn far more about the subject than most liberal arts students.

Physics is the basic science of engineering, which is largely applied physics. It is not likely that a good prospective engineer could really dislike physics, and certainly a chemical engineer should enjoy chemistry. A knowledge of bacteriology is essential to the sanitary engineer whose job it is to guard the public health.

Dean L. E. Grinter

Vocational Tests

It would be wonderful if psychologists and professional testers could pry into our minds, our personalities, and our characters to determine for each beyond question the direction of his true bent in life. You should understand before you read this discussion that such claims are made only by astrologers and mystics. Some day psychology should be developed to the point where it will produce tests of great reliability, but the human mind-personality is so unbelievably complex that improvements in placement testing naturally develop slowly. In the meantime you can make use of tests that have been devised, recognizing, of course, that a test is considered quite successful if it predicts correctly the performance of three persons out of four in a random group.

Even if professional testing can be developed to the point where it accurately measures our interests and aptitudes, it is doubtful that we shall be able to predict by such tests who will and who will not be successful. The picture of one of my former students comes to my mind. He certainly would have scored low in mathematics and science aptitude; by all rules he should have "flunked out" of engineering school in his freshman year.

When he entered my class as a third-year student, he said, "I know I'm dumb in theoretical subjects. I've had to take several theoretical courses twice, but I'm going to be an engineer. If you don't drop me out of your class in the first few weeks, you will find that before the end I will have all of the problems worked correctly even if it takes me half the night every night."

He passed the course and those that followed it and graduated as a civil engineer. By directing his energies into the practical field of construction, he has become a successful practicing engineer.

If you are not unchangeably set on being an engineer or scientist and if you score low on engineering aptitude tests, you would be well advised to try another field. But if you cannot get technology out of your mind and if you are a determined sort of person, for you the tests may be unimportant. Determination wins in every phase of life.

If you have only average aptitude for mathematics, but speak and write easily, you might have difficulty graduating as an engineer and then find yourself successful as a patent lawyer, technical magazine editor, personnel manager, sales engineer, or a promoter of engineering projects. The practical person who is weak on theory may become successful as a production or maintenance engineer and later advance to chief operations engineer or superintendent. The field of engineering is so broad that it provides outlets for men of varied talents.

Techniques—Good and Bad

Depending on whether you get

(Continued on page 44)

BOTTLERS GO TO SCHOOL

Leaders in the carbonated beverage field recognizing the importance of proper training of plant personnel if the industry is to operate at its greatest efficiency recently held a short course on new techniques at Illinois Institute of Technology.

To study the latest technical processes and discuss the problems of production and operation, nearly 50 men and women from various parts of the country spent three weeks away from their plants to come to Illinois Tech for an intensive study course.

The short course, planned by the American Bottlers of Carbonated Beverages, was arranged to help meet the soft drink industry's need for trained technicians and production personnel after the war.

Because of Illinois Tech's standing as a leading technical institution, it was chosen as one of the three schools to give the course. Others selected were Drexel Institute of Technology in Philadelphia and the Agricultural and Mechanical College of Texas, College Station, Texas.

The training was offered to selected employees with sufficient education or plant experience to derive the greatest benefits from such study. Given at the west side campus, it included morning and afternoon lectures five days a week. The group spent its Saturdays in visits to two of the outstanding plants in the Chicago area—the Pepsi-Cola and the Coca-Cola plants.

Dr. R. C. Kintner explains the principles of refrigeration to enrollees in the American Bottlers of Carbonated Beverages short course, given at Illinois Tech's west side campus during February.

Responsible for instigating the course and planning its content were: Thomas Moore of Minneapolis, chairman of the research and technical committee of the American Bottlers of Carbonated Beverages; John J. Riley, secretary of the A.B.C.B.; and H. E. Medbery, its technical director, both of Washington, D. C.

Director of the course at Illinois Tech was Prof. Paul G. Andres, who made the preliminary arrangements here. When Prof. Andres became ill, his duties fell to the lot of Dr. L. R. Hedrick, who was also educational supervisor. He was assisted by Kenneth J. Warren.

Seven members of the Institute's staff participated in the instruction. Henry P. Dutton lectured on the economic aspects of the soft drink industry. Its chemical problems were discussed by L. F. Supple and H. J. McDonald. Dr. R. C. Kintner spoke on principles of refrigeration, and E. Clark Woodward on problems of plant operation, including the efficient use of personnel and employee hygiene.

Architectural aspects of bottling plants was the subject of a talk by A. L. Mell. He took up such matters as principles of construction of the plant, its relation to the surroundings, and its accessibility. Dr. Hedrick lectured on sanitation, germicides, and bacteriological problems.

Specialized features of the soft drink industry, such as syrup making, bottle washing, carbonation, bottling and filling equipment, and flavoring materials, were presented by qualified men in fields allied to the carbonated beverage industry. In addition, the students heard discussions of water

Joyce-Edith Hegner, pretty 19-year-old laboratory technician, youngest registrant for the course in beverage production and plant operation given at Illinois Tech, measures out some Pepsi-Cola before testing the content of the beverage. An IIT industrial chemistry course prepared her for her position at the Pepsi-Cola Bottling Company of Chicago.

purification, sanitation, and safety factors by public health specialists.

"The A.B.C.B. is gratified with the quality of the course, the caliber of the students, and their interest in the training," said Mr. Medbery, who came from Washington to attend the latter part of the Illinois Tech course. "We appreciate the co-operation both of the school and of the supply houses, who provided lecturers for the course.

"It is our hope to conduct a training course in the soft drink field each year."

He also reported that the association is working on plans to introduce courses in beverage production in regular college training.

In the absence of such training, however, the A.B.C.B. short course will probably continue to offer the best opportunity for study in the field. Its importance to personnel in this field is indicated by the fact that some of the students came long distances to attend. One was from Hawaii; another had only recently arrived in Chicago after working in Puerto Rico. Four came from Georgia; and the states of Massachusetts, Washington, and Texas, as well as eleven other states less distant, were also represented.

Along with plant owners, managers, production personnel, and engineers, some of whom had been in the industry for many years, was enrolled 19-year-old Joyce-Edith Hegner, youngest registrant and one of only four women to take the course. Miss Hegner had been working in the industry for only two months before she enrolled for the training and found it of great value in orienting her for her work.

Nor was this the young laboratory technician's first experience at Illinois Tech. After her graduation from Crystal Lake Community high school in 1943, she enrolled in one of Illinois Tech's war training courses in industrial chemistry.

After only one summer course, Miss Hegner stepped right into a position as chemist for the paint and varnish laboratory at the T. F. Washburn company. She worked here for a year before coming to the Pepsi-Cola Bottling Company last December.

Miss Hegner and the forty-eight other students in the A.B.C.B. short course are working harder than ever in these days of acute labor shortages to keep on the market the soft drinks that are so much a part of American life. Fourteen per cent of their output now goes to the armed services, but there is still a large supply for civilians.

The synchromatic system of bottling was of particular interest to soft drink personnel when they toured the Pepsi-Cola plant. Here Miss Marie C. Reilly of Bloomington, Ill., and Fred J. Kazmark of Rapid City, S. Dak., observe the new method, which requires only one operation for filling the bottles.

APPOINTMENTS AND PROMOTIONS

Armour Research Foundation

Promotions

Dr. Haldon A. Leedy has been promoted to chairman of physics research and is in charge of all activities of the section. Formerly co-chairman of the same section in charge of electricity and sound, he has been a staff member since 1938. He received his M.A. and Ph.D. degrees from the University of Illinois after completing his undergraduate work at North Central college.

Russell J. Tinkham has been given the added duties of co-ordinating research on the magnetic wire sound recorder. His title, formerly associate physicist, now advances to physicist.

Three men have been appointed supervisors in the metallurgy section. Martin H. Kalina has been made supervisor in ferrous metallurgy; Ardelle Glaze, supervisor of special projects, and C. B. Haynes, supervisor in welding research.

With his promotion as supervisor of organic research in the chemistry section, Dr. Edward L. Hill will direct the integration of all organic work.

J. Scott Griffith, for the last two years a member of the section on metallurgy, has been transferred to be supervisor of mineralogy. He has been with Armour Research for about four years.

Physics Section

Hans Ekstein, new associate physicist, holds the Ph.D. degree from two universities—Berlin and Paris. He was a research fellow for six years at the University of Paris and has spent two years as director of research for the Commercial Equipment company, Kansas City, Mo.

Henry C. Froula, jr., who has been named assistant physicist, was instructor in physics at Northwestern university for three years and spent half a year at the University of Chicago working on a war project. He is a graduate of North Central college and holds both an M.A. and an M.S. from Northwestern.

The new engineering adviser on the wire recorder is Carl L. Titus, who was formerly associated with Illinois Tech as general supervisor of the code school under the ESMWT program. A graduate of Indiana State Teachers college, he was with Montgomery Ward for thirteen years, as service engineer, research, and buyer of electronic equipment. For two years he has been a sonar field engineer for the Bureau of Ships, Washington, D. C.

Robert L. Landon and Richard J. McCarthy have been added to the staff as instrument makers. Mr. Landon's major experience was with the Dresser Manufacturing company at Bradford, Pa.; Mr. McCarthy's, with the Mall Tool company, Chicago. Other new members of the section are Elinor M. Hoy, junior technician; Emmet J. Lowry, draftsman, who has had many years of experience in commercial art, layout, and precision inspection; and Robert J. Rydberg, machinist, who was formerly with the Simoniz company, Chicago.

Metallurgy Section

George E. Hall, jr., has been appointed metallurgist. He has worked as chemist and supervisor at the Jeffersonville (Ind.) Quartermaster Depot and the Indiana Ordnance Works, Charlestown, Ind. He is a graduate of Clark university, Worcester, Mass., and holds a master's degree in physical chemistry from Boston university, where he also was a teaching fellow.

Sidney A. Sheridan joins the staff as associate metallurgist. For nine years a chemist and metallurgist at the Superheater company, East Chicago, Ind., he has also had several years' experience as materials and process engineer for Curtiss-Wright in Buffalo, N. Y., and in chemical and metallurgical testing for the Illinois Central railroad company, Chicago. He is a graduate of the University of Chicago with a master's degree from Harvard.

Robert J. Teitel has been appointed assistant metallurgist to work on sound recorder wire. His previous experience includes heat treatment inspection for the Allison division of General Motors corporation and metallurgical work for the Houdaille-Hershey corporation, Decatur, Ill.

Natalie Sarie and Marguerite E. Teare are new laboratory assistants in the section. Miss Sarie was formerly a chemistry assistant for C. C. Kawin and company, Chicago, while Miss Teare's experience was with the Coca Cola company and the Human Engineering laboratory.

Chemistry and Chemical Engineering

Dr. John E. Barkley, who has been appointed physical chemist, has a record of two years as research chemist for the Tennessee Valley Authority at Wilson Dam, Ala.; three years in the chemistry department of Ohio State university in Columbus, and two years as control chemist for the Central Kansas Power company at Hays. He earned his master's and doctor's degrees is chemistry from Ohio State after being graduated from Kansas State college.

Transferred from the biology department of Illinois Tech, where he has been teaching since 1939, Dr. Edwin S. Cieslak is now associate biochemist at Armour Research. At the University of Chicago, where he also took his undergraduate work in zoology, he received his doctorate last year in endocrinology. His master's degree was earned at Northwestern.

John H. Jones, who has been appointed chemist, has been with the Food and Drug Administration in Washington, D. C., for seven years as a research chemist. He was graduated from Arkansas State Teachers college, earned a master's at the University of Arkansas, then taught a

year at Coffeyville Junior college in Kansas.

Also joining the staff as chemist is Richard G. McGuire, who received his bachelor's degree at Allegheny college and his master's at the University of South Carolina. After two years as instructor in chemistry and photography at North Georgia college, he went to Terre Haute, Ind., to become foreman on explosives production for the Wabash Ordnance Works of E. I. du Pont de Nemours and company.

Orrie C. Olsen, who took college training in chemistry, was research assistant in the Clinton laboratories at Knoxville, Tenn., before joining the staff as inorganic chemist. He has also worked in the metallurgical laboratory at the University of Chicago.

Gustaf H. Panula, a graduate of Michigan College of Mining and Technology, has been appointed associate chemical engineer. He was associated for five years with the Board of Water and Light Commissioners at Lansing, Mich., as operator at the water plant and chemist at the power plant.

Mrs. Janet S. Splitter was research chemist for George A. Breon and company, Kansas City, Mo., before her appointment as associate organic chemist at Armour Research. She earned her A.B. and M.S. degrees at the Universities of Kansas and Minnesota, respectively.

Donald F. Thompson received his B.S. and M.S. at Tufts college and was an instructor there two years. He spent a year as research chemist for the Doble Engineering company, Medford, Mass., before coming to the Foundation as assistant organic chemist.

Dr. Leonard J. Vinson has joined the staff as associate biochemist. He has published several papers on vitamin work and held the Nutrition Foundation post-doctorate fellowship for 1944, working at Fordham university with Dr. L. R. Cerecedo. After his graduation from Brooklyn college, he received his master's and doctor's degrees at Fordham and for two years served there as instructor in physical and organic chemistry.

Charles W. Tatter, a chemical engineering student at Illinois Tech, is working half time at the Foundation as junior technician. Hans L. Landay, who has been appointed glass blower, formerly did similar work for the General Electric company, Schenectady, N. Y.

Engineering Mechanics Section

A former junior engineer at the Curtiss-Wright corporation in Columbus, Ohio, Lois J. Broder has been appointed research assistant. She studied at Wright Junior college and at the Universities of Chicago and Minnesota, specializing in aeronautical engineering at the latter.

Jose Capacete, a native of San Juan, Puerto Rico, received his bachelor's degree in civil engineering at the University of Dayton. He is now assistant engineer at Armour Research.

Ruth Goldblatt comes to the Foundation as electronic laboratory technician after fifteen months' experience teaching radio fundamentals at the Army Air Forces Technical Command, Truax Field, Wis. She is a graduate of the University of Chicago.

Arpad Klents, who was recently appointed research engineer, took his training at the State College of Engineering in Budapest, Hungary. Among the organizations for which he has done work in design and development are the American Locomotive company, New York City; Sargent and Lundy, Chicago; and the Arthur McKee company, Cleveland.

William E. Lauterbach, new assistant engineer, will receive his bachelor's degree in mechanical engineering from Antioch college in June. In connection with his college training he held positions at the Houde Engineering company, Buffalo, N. Y.; Babcock and Wilcox company, Barberton, Ohio; and the engineering department of the City of Dayton, Ohio.

Arthur S. Leonard comes from California to serve as associate engineer doing research in thermodynamics. He did orchard heater research at the University of California's agricultural experimental station, worked in the engineering and research departments of the Standard Oil Company of California, and was magnesium foundry control technician at the State College of Washington. An electrical engineering graduate of the University of California, he received a master's degree in mechanical engineering at the same school.

Dr. V. L. Streeter, who has been teaching civil engineering at Illinois Tech since 1941, has been transferred to the Foundation as supervisor of fluid mechanics. Dr. Streeter worked as engineer with the U. S. Bureau of Reclamation in Denver for five years and later was associate hydraulic engineer for the Inter-Boundary Commission between the United States and Mexico. He took both his undergraduate and his advanced work at the University of Michigan, receiving his doctor of science degree in 1934.

A mechanical engineering graduate from New York university, James N. Vlachos was apprentice and sales engineer for the Elliott company at Jeannette, Pa. He is now assistant engineer at Armour Research.

Other new appointees in the engineering mechanics section are Raymonth J. Aimone and Paul J. Nieland, machinists, and Edgar D. Pauls, electronic laboratory technician.

Ceramics and Mineralogy Section

Joseph T. Dusek has returned to the Foundation as assistant ceramist after a year's absence. A graduate of Illinois Busniess college, he was associated with the ceramics department at Lewis institute for several years before it was transferred to Armour Research.

Electrical Engineering Section

L. W. Matsch is working on electrical development and research as an engineer in the new electrical engineering division. For many years a part-time instructor in the evening school at Lewis institute and Illinois Tech, he is now a full-time staff member of Armour Research. He has behind him seventeen years in the testing department of the Commonwealth Edison company, where he worked on the development of methods and electrical measurements for special studies on high voltage equipment, abnormal behavior of current transformers, etc. He is a graduate of Illinois Tech.

Diesel Laboratory

Robert Ladevich, an Illinois Tech graduate in mechanical engineering, has been appointed assistant engineer working on mechanical engineering design, construction and calculations. He previously worked with the Chicago plant of the Dodge company as project and test engineer.

Others who have recently joined the laboratory's staff are Otis L. Welch, engine operator, and Clifford R. Youmans, engine operator and mechanic.

Shops

James V. Carlisle is the new machine shop superintendent. He studied mechanical engineering at New York university and was shop and design engineer for nine years at the Ethyl corporation in Detroit.

Other newcomers to the shops are G. A. Carlson, John Craven, and John Peters, machinists, and John J. Corrigan and George W. Lohmann, doing maintenance work.

Secretarial and Clerical

Seven persons have been appointed to secretarial and clerical positions. They are Alfreda M. Goraleski, Virginia Kendall, Shirley Lewis, Sylvia L. McCrone, Alice M. Powers, Mary Sexton, and Juanita Snyder.

HELP! HELP! HELP!

By

JOHN J. SCHOMMER

Last summer there was considerable cancellation of materials of defense nature and thousands of employees were discharged. Thousands of women in defense plants have been quitting their jobs every month since a year ago last July. The Selective Service System has been depleting the ranks of our older male workers and taking the young lads attaining eighteen years of age for the armed service; many younger than eighteen have been enlisting. Also, many workers were jumping from defense industries to peace time industries—so the shortage of manpower in industry, when our hopes for a sudden collapse of the war in the autumn of 1944 went into a tail spin, became acute.

Without assuming the guise of a "grandstand Monday morning football coach" who can tell exactly what the losing coach of the previous Saturday's game should have done to win the game (I am leaving that to the "hot stove leagues" all over the country to debate around the cracker barrels for years to come) the bald fact is, many thousands of workers are urgently needed now in defense industries to insure a speedier ending of World War II.

This office has been besieged by phone, letters, and personal calls for changes of positions. Most of the calls have been for changes of positions to peace-time industries with excellent chances for the "long pull." If everybody were allowed to do this our armed forces would soon be fighting with bean blowers and sling shots. Stay on your defense jobs until victory is won. If you must change your job, do it for reasons of going to a defense job where you may be more valuable than you are in your present employment or for a change of employment due to your health, or a change of climate necessary to your health or that of your family.

John J. Schommer

If you must change positions for the reasons stated, be sure you secure a certificate of availability from your employer. Then go or write your local draft board to secure their approval. Then go to the nearest United States Employment Service office, state your case, and secure their approval. Then you may change your position. Whatever you do, do not fail to secure your local board's permission to change or you may find yourself in the army.

There is much press and radio talk regarding workers in the classes designated as 4-F and 1-A(L). What will be done in Washington by our statesmen relative to these classes is not yet clear. However, your local board could and can make things very uncomfortable for you if you are in these categories and if you do not ask their permission to change jobs, or if you are working in a non-defense industry. This is so for those males between the ages of eighteen though thirty-seven years of age.

Do not become panicky about being left without a job when this war is over. First, make sure there will be a country, as ours is, to work in when the war is over. Remember many engineers are being killed and wounded in the service and many engineers will stay in the armed service after this war is over. Remember many engineers also are being retired and are dying in industry. Remember Selective Service System's directives have almost cut off the supply of engineers at the source.

A personnel director of one big industry told me his company had over 1300 engineers in the armed service and everyone has been offered a job when he is mustered out. He also said if all of their former engineers came back to them, his firm still will need 571 additional engineers as soon as peace is declared. For every engineer retired for old age, from three to nine engineers are needed to start toward the top. This is so because the young engineers after a trial are dropped, die or leave for other jobs. When the youngster reaches retiring age, he is one of the three to nine left. This plan of hiring from three to nine engineers that have just graduated varies numerically with different industries.

The demand for engineers is still tremendous. In one week in January this office was requested to supply 1500 engineers for 12 industries. Let's hope that demand will always be high and urgent for "Illinois Tech" graduates.

BETTER MOUSE TRAPS

Filler for Water Canteen

By

LOUIS E. ANDERSON

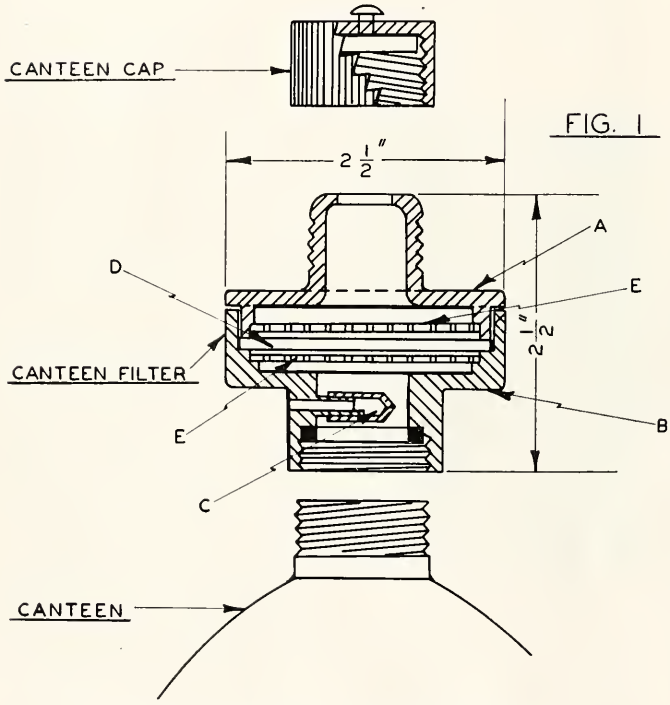


Fig. 1. Cross Section of Assembled Filter Unit

A drink of pure water is enjoyed by all, especially if the water is crystal clear and free from disagreeable tastes and odors. Most cities and towns have deep wells or filtration and chlorination plants which insure adequate supplies of good, pure drinking water.

To the armed services, however, and especially to the advance units, the problem of a satisfactory water supply is not so easily solved. These first line fighters must depend entirely upon local water supplies such as wells, rivers, lakes, or creeks, most of which are not only dirty but contain harmful bacteria. A chemical treatment, usually chlorination, can be used to destroy the bacteria and a filtering process will remove the dirt, but the water will then be left with an extremely objectionable chlorine taste unless some simple expedient can be employed to make the water more palatable.

One solution to this problem was achieved by a Chicago concern in the development of a canteen filter which not only removes dirt but also renders the water tasteless and odorless. This unique device, illustrated in cross section in Figure 1, consists of four main parts, an upper housing, A; a lower housing, B; a bleeder valve, C; and a filter pad, D.

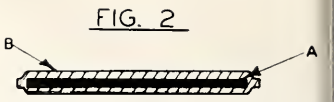


Fig. 2. Cross Section of Filter Pad

The upper and lower units, A and B, are threaded and fit together as shown with the filter pad, D, locked into position on a shoulder of the bottom unit, B. Perforated plastic plates, E, are set above and below the filter pad to support the latter. By simply unscrewing the two main housings, the filter pad may be changed as necessary, after which the entire unit is replaced on the canteen outlet with the regular canteen cap fitting on top of the filter unit.

The filter pad, D, was developed by the Chemical Engineering section of the Armour Research Foundation in collaboration with Hawley Products of St. Charles, Illinois, and is pictured in Figure 2. In this cross sectional view the center portion, A, is composed of activated carbon, entirely surrounded by a layer of fibrous felt, B. The thickness of the unit is approximately .125".

In operation, the canteen is filled with water, the chlorinating pellets dropped in and the filter adapter replaced. In subsequently using the canteen, the water passes through the filter to have the solid foreign matter removed from it by the fibrous felt. At the same time the activated carbon renders the water tasteless and odorless. A single filter pad will purify approximately two and one-half gallons of water containing 20 parts per million of chlorine.

Also, a full canteen can be emptied in approximately one minute which represents an unusually high flow rate in view of the amount of activated carbon required. This relatively rapid flow rate is aided by the bleeder valve, C, shown in Figure 1, consisting of a small rubber tube having one end open to the atmosphere. The other end is slit in such a manner as to permit air to enter the canteen when a differential pressure is created by withdrawing water from the container. In this manner a steady flow is assured.

Hunters and fishermen should find this filtering device very useful when it becomes generally available in the post-war period. It will be a boon, too, to those whose homes are located in areas having contaminated water supplies.

The youngest member of the Technology Center family is now approaching its fourth birthday. Founded in 1941 as a result of the activity of an American Gas Association committee, the Institute of Gas Technology was established as an independent educational and research organization, where the fuel gas industry could conduct research in both basic and applied problems, and enable outstanding young men to receive graduate education fitting them for positions of future leadership for the industry. Patterned after the successful Institute of Paper Chemistry in Appleton, the new Gas Institute was affiliated with Illinois Institute of Technology so that its graduate program might operate in conjunction with that of Illinois Tech. Also, the central location of Chicago made it possible for member companies scattered throughout the entire United States to reach the Institute without difficulty.

Since its beginning in 1941, the Institute has greatly expanded its floor space, its personnel, and its scope of activity. Housed in the State Street building, adjacent to the Armour Research Foundation, the Gas Institute has gradually increased its floor space, until approximately 14,000 square feet are now occupied, in addition to another 6,000 square feet in the fourth floor of Machinery hall which can be used for the duration. The space now available will be adequate for the needs of the Institute until a new building can be erected in the post-war period.

Of equal importance in the minds of the industry leaders who founded the Institute were the educational and research programs. The educational program was designed to attract outstanding graduates in chemistry and chemical engineering from leading American universities, to support them through fellowships during their academic residence, and to give them employment on a co-operative basis during the summers. Starting with a few fellows in 1941, the educational program expanded until, in February, 1944, 20 fellows were in attendance. However, the drastic curtailment of graduate study which took place at that time had the same effect on the Gas Institute program as on all other graduate education, and virtually all of the fellows discontinued their studies in order to enter the armed services, or to go into essential war industry.

However, before the program was suspended, three of the young men had obtained their master's degrees, and one other is well on the way to the doctorate. It is expected that

the graduate program will be resumed by September, 1946, and the original pattern will be followed with a few variations which experience has indicated to be desirable. The co-operative program of alternate work and study periods will be followed, and it is probable that the classes will be so alternated that two groups will be in residence continuously while one group is at work in the industry. This type of post-graduate co-operative work is relatively new in the American educational system, although it is interesting to note that one of the leading radio manufacturers has recently proposed a similar plan in conjunction with Massachusetts Institute of Technology.

Of paramount importance during the past year has been a successful effort to augment the staff of the Institute, and to gather a group of scientists who can attack the manifold problems of the industry with confidence and enthusiasm. The Institute was strengthened in June of 1944 by the addition of Mr. L. J. Willien as associate director. Widely known as

Fig. 1. Dr. J. J. Sebastian, Co-Supervisor of the Coal and Gasification Section, discusses fluidized gas generation with G. C. VonFredersdorff, Illinois Tech '44.

Fig. 2. Apparatus for the production of coke from Illinois Coal is being assembled by William Volk of the Coal and Gasification Section at the Gas Institute.

the dean of the manufactured gas industry, Mr. Willien has received virtually all of the honors which can be bestowed by the gas industry in recognition of his publications. Mr. Willien is now acting as a consultant on gas problems for the Bureau of Mines, and he is in charge of the work now being done by the Gas Institute for the American Gas Association.

Other additions to the staff during the past year have included Mr. George D. Creelman, who came to the Institute after extensive experience with the M. W. Kellogg company and the Monsanto Chemical company. Mr. Creelman is the administrative assistant to the director, and is in charge of personnel problems and patents. He also supervises the important work of the library where Miss Barbara Hopkins serves as librarian. Mr. Frank Knoy came to the Institute from the Long Beach Municipal Gas company, where he had worked for several years on the application of gas to industrial problems. Mr. Nathan W. Muller, formerly an instructor in chemical engineering at Illinois Institute of Technology, and more recently associated with the Standard Oil company of Indiana, joined the Institute in November, along with Mr. R. T. Griffith who received his master's degree from Illinois Tech in 1941, and had also been acting as an instructor in the

chemical engineering department. L. J. Kane, Armour, 1928, joined the catalysis section in October, to work on problems related to natural gas condensates. Dr. Eric Lype came from the De Laval Steam Turbine company to work on problems related to gas turbines, thermodynamics, and kinetic theory. Mr. Witold Stopowy, who holds the degree of master of science from the Technical University of Lwow, came from the Natural Research council of Canada to assist in a study of foreign gasification processes.

Other additions to the staff include Raymond C. Gardner, Illinois Tech, 1944; C. B. Folkrod, Armour, 1937; Thomas J. Kenny, Illinois Tech, 1943, and C. G. VonFredersdorff, Illinois Tech, 1944. Other new staff members include E. A. Walsh, Minnesota, 1940; William Volk, New York University, 1939, and Lewis B. Leder, Idaho, 1943. The most recent additions to the staff include Mr. Morris Fisher, who received the degrees of B.S. and M.S. from Carnegie Institute of Technology and served seven years with the Bureau of Mines and Dr. Sidney Katz, who holds the degree of B.S. and M.S. from the University of Manitoba and the degree of doctor of philosophy from the University of London.

It is the intention of the Institute to develop versatile scientists who can apply effective research methods to the solving of a wide variety of problems. A group of competent section supervisors has been gathered, each of whom is responsible for projects in a particular field of science. Thus, general problems in chemistry, both organic and physical, are usually referred to the chemistry section, under Dr. S. W. Martin, Ph.D., Yale, 1935. The current major project in this section is related to the identification and removal of organic sulphur, long a major problem in the manufactured gas industry. In addition, thanks to the co-operation of the physics department of Illinois Tech, Dr. Martin's section has been applying the electron microscope to the problems of carbon black production. The latter assumes particular importance because of the vital role played by this material in the production of synthetic rubber tires.

Dr. V. DeMarchi, Ph.D., Columbia, 1938, is in charge of work related to metallurgy, while Dr. J. D. Parent, Ph.D., Ohio State university, 1933, supervises projects in the field of chemical engineering. Work in appliances comes under the direction of John Massier, M.S., Wisconsin, 1934, while Dr. Charles Riesz, Ph.D., Armour, 1939, is in charge of work in the field of catalysis. Dr. Vasili Komarewsky acts as the Institute's consultant in this field. Problems related to the carbonization and gasification of coal occupy a large part of the Institute's program, and this sec-

(Continued on page 42)

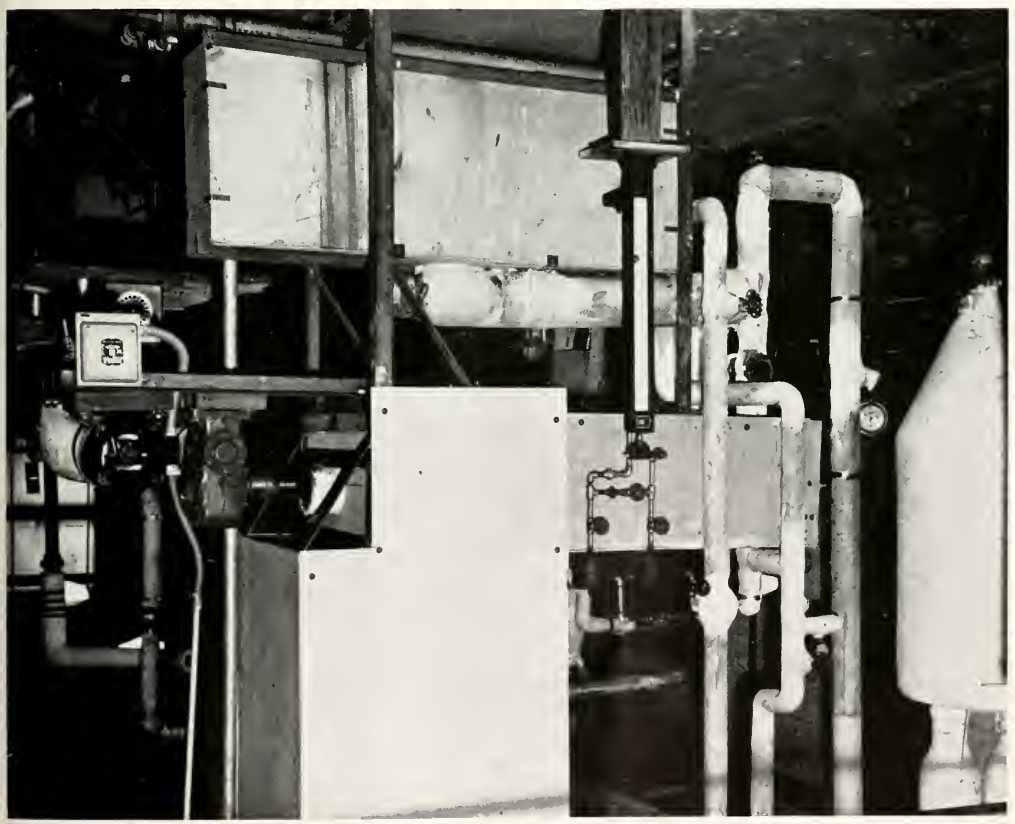


Fig. 3. The flash pulverizer, being developed at the Gas Institute as a means of preparing coal for steam generation and gas production.

MEN OF THE MONTH

Blake C. Hooper
and
James A. Rafferty

Blake C. Hooper

An active worker in the alumni association for a number of years, Blake C. Hooper was elected this year to the office of vice-president.

Hooper, who received his bachelor's degree in mechanical engineering in 1907, is in partnership with S. John Walden. Together they serve as field representatives for several manufacturers, devoting much of their time to the Baker-Raulang company of Cleveland, Ohio, makers of storage batteries and gas electric units.

Hooper's career as a manufacturer's representative began in 1916, when he went to St. Paul to organize a corporation for persons specializing in accounts for railroad supplies. In 1926 he became assistant general sales manager for the Raulang company at its headquarters office in Cleveland.

Feeling that the company needed better coverage in the middle west in 1931 he returned to Chicago, his home city, as district representative. It was at this time that he became a partner of Walden. Their office at 407 South Dearborn street is in the same building in which Hooper worked when he first left Armour.

In his work on Raulang trucks, Hooper was faced several years ago with the problem of developing a truck low enough to go under the wings of a plane at an airport and produced a satisfactory truck. Later, after the airport no longer needed such trucks, a new demand for their use was found in low-ceiling mines.

Blake C. Hooper

Previously donkeys had been the only means of power in such mines. In visiting one of the mines, Hooper recalls, he saw a donkey that had been trained to spread his legs and practically crawl through a very low tunnel.

Hooper served a year as captain in the ordnance division during the first World War. He remained in the reserves for three years after the war. At present he is a member of the Beverly Hills American Legion Post, No. 407. In 1942 he took an intensive training course at Mormoyle motor base, given to a select group of men from twenty-eight states.

A member of the Association of Iron and Steel Engineers, the alumni vice-president enjoys horseback riding and bridge. In Cleveland he played a great deal of tournament bridge, and Culbertson described a hand played by Hooper in one of his articles.

Hooper and his family live at 9001 South Claremont avenue, Chicago. His two older daughters, Dorothy and Joyce, are graduates of the Loring School for Girls. A younger daughter, Jean, attends the same school, of which her father now serves as a trustee. A nephew, Blake H. Hooper, now an ensign, was graduated from Illinois Tech in 1944.

James A. Rafferty

James A. Rafferty has been a pioneer and leader in a branch of chemical industry which, although practically unknown and unexplored twenty-five years ago, has today become a source for hundreds of synthetic chemical compounds upon which are founded many American industries as for example Bakelite. Mr. Rafferty is president of Carbide and Carbon Chemicals corporation, and a vice-president and director of the parent organization, Union Carbide and Carbon corporation.

Mr. Rafferty obtained his technical education at Lewis Institute, having graduated in 1908 with the degree of mechanical engineer. At college, he took a special interest in chemistry. Upon graduation he went to work as a chemist for the Peoples Gas Light and Coke company in Chicago. He worked for that company for nine years, during which time his ability and industry were rewarded with a number of promotions. Successively he held positions as chief chemist, plant engineer, foreman, assistant plant superintendent, and distribution

superintendent. In 1917 he accepted the position of assistant general superintendent of plants with the Linde Air Products company, New York, later to become a unit of Union Carbide and Carbon corporation.

Mr. Rafferty has been the mainspring of the Chemicals corporation since its creation in 1920 as a unit of Union Carbide and Carbon corporation. As general manager of what was then a new enterprise, he first scouted the Kanawha valley region of West Virginia to locate sources of raw materials and a suitable plant site for developing synthetic organic chemicals from the natural gases so abundant in that region. Starting with little-known processes and practically unknown products, Mr. Rafferty and his colleagues literally created a new industry—an industry which grew in size from a tiny shack and compressor station in the West Virginia hills to the present day plants at South Charleston, W. Va., the largest single chemicals property in the country; and at Whiting, Indiana; Texas City, Texas, and Niagara Falls, New York. Mr. Rafferty has been continuously engaged in the management of the Company, serving for several years as vice-president and since 1929 as president. His industry, vision, and managerial ability, combined with a sound engineering background, have been largely responsible for one of America's greatest chemical enterprises.

The idea of using natural and petroleum gases as potential sources of

James A. Rafferty

hydrocarbon raw materials grew out of the original research which has been conducted by some of the corporation units. Today these chemicals include solvents for lacquers and other surface coatings, chemical intermediates for the production of medicines, dyes, rayon, and plastics, and chemicals used in such products as anti-freezes, compresses fuel gases, and hydraulic fluids. They are playing an increasingly important part in practically every American industry. For example, the textile industry uses a score of these chemicals in the processing and dyeing of fabrics; the amazing development of the plastics industry is due largely to synthetic organic chemicals; the aircraft industry uses these chemicals for cooling fluids, insulating materials, paints and lacquers, as well as for numerous plastic parts; the petroleum industry requires vast quantities of these chemicals for the manufacture of lubricants and high-test gasoline.

In fact, the technological experience and engineering background developed by Mr. Rafferty and his associates have opened up new horizons in the world of chemistry. Last year processes developed by Carbide and Carbon Chemicals corporation were responsible for the production of more than three-quarters of the butadiene for the government's synthetic rubber program.

In addition to being president of Carbide and Carbon Chemicals corporation, Mr. Rafferty is also president of Bakelite corporation and a director of several other units of Union Carbide and Carbon corporation, including the Linde Air Products company, the Prest-O-Lite company, Inc., Union Carbide and Carbon research laboratories, Inc., the Oxweld Railroad Service company and Electro Metallurgical company. In February, 1944, Mr. Rafferty received an honorary degree of Doctor of Engineering from the Illinois Institute of Technology.

Mr. and Mrs. Rafferty have four daughters and two sons. Two of the daughters are married. His family occupies most of his time and interest away from his work.

POWER FELLOWSHIP

Details of a graduate fellowship in power systems engineering established by the Westinghouse Educational Foundation at Illinois Institute of Technology have recently been announced by Dr. Henry T. Heald, president of the Institute.

The first recipient of the fellowship, to be selected jointly by Illinois Tech and the Westinghouse Foundation, will begin his work next July with a $3,000 grant to cover three semesters of graduate study and research.

For this period he will be provided with funds for tuition, equipment, and general expenses so that he can devote his time under expert instruction to a careful study of the working of power systems. On completion of the work, he will be eligible for the master of science degree.

The fellowship program was developed jointly by A. C. Monteith, representing the Foundation, and Dr. Jesse E. Hobson, a former engineer of the Westinghouse Company who until recently was Director of Electrical Engineering at Illinois Tech, and now heads the Armour Research Foundation of the Illinois Institute of Technology.

The objective of the fellowship is to train superior men in the field of power systems engineering, to give them experience on the network calculator, and to acquaint them with active research problems in the field of power systems engineering. The recipient of the award will be selected by a committee representing both Illinois Tech and the Westinghouse Foundation. He will probably be either a recent graduate, or a promising young engineer with some experience in utilities or the electrical industry.

At the end of the first term, in which he will devote most of his time to study, the fellow will have the opportunity to spend a week or two with the Westinghouse central station engineering group at East Pittsburgh in order to familiarize himself with the operations and problems of central station engineering.

During his second semester he will devote about half-time to study and half-time to work with power companies in their studies on the Westinghouse network calculator, recently purchased by Illinois Tech.

Two more weeks of industrial experience will follow, at which time a research project will be outlined in conference with power engineers. This project is expected to involve

(Continued on page 43)

MIDWEST POWER CONFERENCE

1945 Meeting Cancelled

By
STANTON E. WINSTON

The following telegram was received by the director of the Midwest Power Conference on February 9 from the secretary of the War Committee on Conventions: "Your application (of January 17) for permit to hold meeting Chicago April 9-10 has been reviewed. Committee feels that meeting can reasonably be deferred until necessity for restriction ends. Permit therefore denied." In accordance with this decision, the 1945 meeting of the Midwest Power Conference has been canceled.

A brief review of past events relating to the holding of group meetings may be of interest. Early in January, a War Committee on Conventions was formed under the chairmanship of Colonel J. Monroe Johnson, Director, Office of Defense Transportation. This committee was instructed by the Director of War Mobilization and Reconversion, James F. Byrnes, with the approval of the President, to effect a cessation of group meetings, such as conventions and trade shows after February 1, 1945, which in its judgment were not necessary to the war effort. This action of course was taken to help relieve overburdened transportation and hotel facilities and thus aid the war effort. It thus became imperative that anyone in charge of a group meeting of more than fifty persons, not purely local in character, scheduled to take place after February 1, either summarily cancel the meeting or apply to the committee for permission to hold the same.

The directorate of the Midwest Power Conference considered immediately the situation in which the conference had been placed by this turn

Stanton E. Winston

of events and after due deliberation decided to ask permission to hold the 1945 meeting. To this end, a standard application form was filled out and mailed to the War Committee on Conventions on January 17. This decision was based on the opinion that the conference had been and would be a contribution to the war effort, and that it is regional in character, necessitating a limited amount of transportation, and on the fact that plans for the 1945 meeting and the program had been nearly consummated.

To mention a few of these arrangements: Thirty-two men had accepted invitations to participate in the program and many papers were well under way. Thirty-thousand stickers had been printed and one-third of them had been distributed to firms who were already using them on their letterheads. Many news releases had been sent out and publicity had appeared in many magazines. All arrangements with the Palmer House had been completed. Envelopes had been addressed to those on our mailing list. All co-operating institutions had been contacted. The 1945 meeting was indeed well under way.

The directorate wants to make it clear that it is in complete agreement with the idea of Justice Byrnes that to relieve overburdened transportation and hotel facilities will be a great aid to the war effort. Nothing in its action in applying for a permit to hold the 1945 meeting should be construed in any other manner. Now that the War Committee on Conventions has rendered its decision, the conference directorate is only too glad to abide by that decision.

It is a disappointment of course that it is impossible for the conference to go ahead with its 1945 meeting and it is hoped that the turn of events has not discommoded those who were to participate therein too greatly.

The future? Yes, indeed, the annual meetings of the conference will be resumed as soon as present restrictions are lifted. It has demonstrated its worth in the past and will continue to do so in the future. In the mean time, to Victory and then an everlasting Peace on Earth with Power!

CHEMISTRY--ALADDIN'S LAMP

By
WILSON I. DOAN

By way of introduction, prior to the first World War the layman classified the chemist as belonging in about the same category as a magician. In those days, prior to 1914, the American chemist was presumed to retire to a small, smelly room called a laboratory, where he performed an experiment, in the nature of magic, such as changing the color of some liquid from red to blue, or causing some dry or solid substance to become a liquid or even a gas. But at that time not more than a comparative handful of men perceived any connection between these experiments and the economy of the nation.

World War I brought to America the realization of the science of chemistry. Some of this came to us in those times under the stress of dire necessity. Many of you will recall the German submarine, Deutschland, which made more than one trip to the United States with cargoes of concentrated aniline dyes, valued at millions of dollars, prior to the time when our country declared war on this enemy. But even before we had entered the conflict, one American chemical manufacturer was producing synthetic Indigo on a commercial scale. Now synthetic Indigo probably runs into larger tonnage than any other single dye, and until the autumn of 1916, the Germans were the exclusive producers. I am mentioning this case to direct your attention to this important fact about our industry—the American chemist is and has been alert to the needs of the nation in both peace and war.

Today the science of chemistry would seem to those of us within the industry as being more akin to the realm of legerdemain than it was 25 or 30 years ago. But this is not true of the layman. While he may not realize how intimately chemistry touches and influences his life, still the newspaper and the radio have given him an acquaintance, if not a familiarity, with the science. This, it seems to me, is the more remarkable when you consider that the basic chemical producer makes very few things for the ultimate consumer which can be recognized as a product of chemistry. How many of you think of chemicals when you look at a tire, at composition shingles on a roof, at the clothes and shoes which we wear or even a glass of drinking water.

There is more to the preparation of drinking water than merely giving it a "shot" of chlorine. While the rubber tire of yesterday was built in part of natural rubber, still various chemicals played a most important part in the manufacturing process. Indeed, a large tire and rubber producing plant is in most respects a big chemical works. This fact aided our country to a marked degree when the present World War brought about the necessity for synthetic rubber. All of the large tire companies had their trained forces of chemists and chemical engineers who were ready to tackle this problem and who seem to be meeting with success in their efforts.

While I could direct your attention to many ways in which chemistry is playing an important part in your lives, it would be absolutely impossible for me to include even half of these applications. Your home, your food, your automobile and your radio have all been developed to a higher degree of perfection and efficiency through chemistry. Even the air we breathe may be improved by controlling the amount of humidity and this is done in a large measure by chemical action. Speaking of the air we breathe, a chemical professor at the University of Chicago has about completed his tests over a period of three or four years whereby the public will be able to control influenza. This is accomplished by spraying or atomizing very small quantities of a certain chemical in the rooms of our homes and, particularly, in places of public gatherings. I believe it will surprise you to know that the chemical used for this purpose is not at all expensive and is very closely akin to the chemical which is used for antifreeze purposes in the radiators of many of your automobiles, called "Prestone."

Certainly, the farmer will benefit in some measure by the thought and attention which have been directed during the past 10 years toward the utilization of agricultural products for the purpose of producing chemicals. The claims which have been made concerning the economy of producing chemicals from agricultural products are, probably, just as sound as the claims which had been made that we could synthesize rubber. The difference is that World War II brought on an urgent necessity for immediate results in the production of synthetic rubber. When, if ever, we run short of basic products, we will certainly turn to agricultural products for at least some of our basic chemical materials.

The science of chemistry has been responsible in some instances for the development of whole new industries and I can think of no better example of this than the industry we are pleased to term today as "Plastics." The earliest commercial history goes back as far as 1870, at which time, in a search for substitutes for ivory, a product formed of cellulose nitrate compounded with camphor was found to have commercial applications for sheets, rods and tubes. These were converted to such common items as combs, brush and mirror backs, fountain pen barrels, buttons, etc. This type of material, known to us as "Celluloid," still has broad application today. From that time, however,

until the period immediately following World War I only two additional types of plastic compounds reached the market.

From the period of 1918 to 1941, thirty-five basic, commercial types were introduced and are in more or less wide use today. This phenomenal growth over such a brief period had at the end of 1941, reached a total production of 350 million pounds, not including those plastics used in fabrics, yarns and other border-line applications.

Normally, plastics are thought of as those materials that are formed or worked by various processes to make the objects commonly used in our everyday life. We think of them as switch plates, light plugs, percolator handles, automobile steering wheels, etc. To those of us in the industry, however, the term covers a very broad classification of materials. In many instances it is broader than the term "metals," which, of course, may include products differing as widely as steel and mercury.

A plastic may be a clear, flexible, glass-like material used in suspenders, the hard rigid and opaque material used in the telephone in your office; or it may be the base for the paint used in your home or the rayon or nylon fabrics that have become so popular. It may be a specific material highly resistant to corrosive acids, alkalies and the like, or it may be woven into screen, made into floor tile, wall board, fabric coatings, artificial leather, etc. Without it we could not have radio or radar, electric lights, automobiles, of the quality and efficiency which we enjoy today, and many of our accepted aids to a full life.

As with metals, basic plastic materials can be alloyed to give a product unlike any of the alloying materials. The synthetic rubber I have mentioned before, is a timely example of such an alloy or copolymer as it is known to the chemist.

Contrary to the public concept of miracle working, the story of plastics is a *modern-day* version of alchemy. It is not the story of a vain search for a magic formula for the transmutation of common materials into gold, but rather the chronicle of hard, solid work necessary to develop processes for the conversion of basic raw materials and, in some cases, wastes into usable products on which civilization and progress can be built. The element of chance may have played a part in early development, but only hard work and painstaking research have made possible the commercial materials you have today.

These phenomenal strides made by so young an industry have convinced the public that we are on the verge of a "plastic age." We hear of plastic airplanes, plastic automobiles, plastic furniture, even whole houses. According to some commentators, metals, glass, wood, etc., will lose a large part of their importance in every-day life. Although we must temper such optimism with economics and cold, hard facts, we cannot help, when we consider the strides made in recent years, realizing we should avoid any thought of the word "impossible."

With plentiful supplies of raw materials, convertible by the science of chemistry, to an almost unlimited variety of end products, and with an already wide-spread public acceptance, certainly a most promising future can be expected for this, one of the newest of chemistry's developments.

What about post-war activities? This is a question which is commanding much attention in our newspapers and at every gathering of business men. Particularly, those of us in sales and advertising fields are conscious of this problem which will soon confront us. My personal opinion on this subject is that we will all proceed much the same as we have in the past so far as basic commodities are concerned but that our sales and advertising activities will be stepped up to a higher tempo. You might reasonably anticipate some innovations in the merchandising of new commodities and of specialties with which the public has limited information, especially articles and processes which have proved their merit to the armed forces but which, due to limited production, military secrecy or for some other reason, have not come to the attention of the general public. Certain applications of the plastics may fall within this category. But for the everyday commodities, the basic materials, upon which industry relies for its bread and butter, you will find that we will resort to intensified efforts. This will embrace more careful buying, closer scrutiny for reduction in production costs, prudent advertising programs, thorough market analyses and constructive selling.

However, post-war activities involve more than the production and marketing of those items with which we are now acquainted. We must continue to progress, we cannot remain static. Our present products must continually be improved. New materials and extended uses of the old as well as the new must be created. In the chemical industry this type of progress is the responsibility of our research departments. The exceptional growth and development of the chemical business can be attributed primarily to judicious management and extensive research.

What about the post-war prospects for research? If there is any sphere of business life where free initiative is necessary, it is here. This is true whether we consider the individual research chemist or the research department of some company. While supervision and direction of effort on the part of management is essential—and the growth of the chemical industry during the past 25 years amply proves it—these men and their departments cannot be regimented and operate efficiently. If, through political pressure or otherwise, the ambitions and development programs of the individual companies are curtailed or even directed by other than the active and interested managements, research is immediately affected. It has lost its efficiency because it relies so completely on initiative and this attribute will not and cannot be regimented.

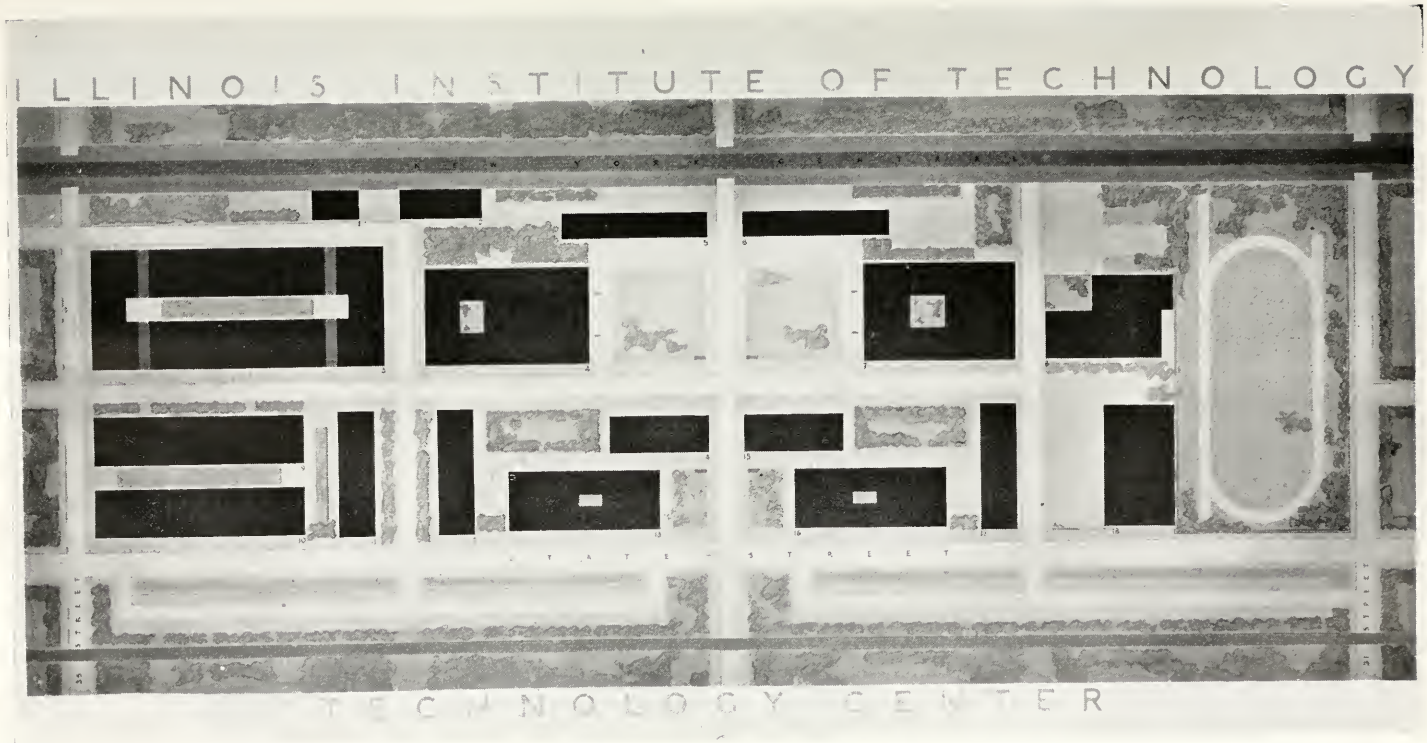
Since I really would like to stick to a subject I know something about without unduly advertising my company on such an occasion as this, perhaps it is appropriate to talk about a chemical company which has rubbed the Aladdin's lamp of nature and caused giants of chemical industry to rise from the sea.

So much has already been written by the scientific editors about the possibilities in post-war developments, that it is scarcely the function of the makers of new products—new basic products—to attempt to compete in predictions about such matters as transportation and communication systems, or foods, medicines, and the like. We people who are engaged in basic chemical manufacture realize, rather, that we are part of an industry which is, so to speak, just "coming of age."

We have developed large plants from the standpoint of consumption of raw materials and power, but not so large in the matter of employment of large numbers of workers. We are a process industry rather than a manpower industry.

In general, chemical industry supplies the old basic chemicals which are useful to the rubber, automotive, textile, leather, and other industries, and, at the same time, through research, it evolves special products related to these older chemicals which are also of great utility to these same industries. The production of these so-called specialty items brings the chemical manufacturer closer to the manpower production line methods

(Continued on page 53)



Shown above are the buildings and plans for construction at Illinois Institute of Technology as soon as priorities and war conditions permit. Proposed campus as shown here runs from 31st Street (on the north) to 35th Street (on the south), and from State Street (on the east) to New York Central tracks (on the west).

The key numbers indicate:

1. *Power House*
2. *Foundry Building*
3. *Engineering Building*
4. *Auditorium and Student Union*
5. *Physics and Electrical Engineering*
6. *Chemical and Civil Engineering*
7. *Library and Administration*
8. *Gymnasium and Natatorium*
9. *Research Laboratories*
10. *Research Laboratories*
11. *Gas Institute*
12. *Armour Research Foundation*
13. *Mechanical Engineering*
14. *Architecture and Applied Art*
15. *Chemistry*
16. *Metallurgy*
17. *Humanities*
18. *Fieldhouse*

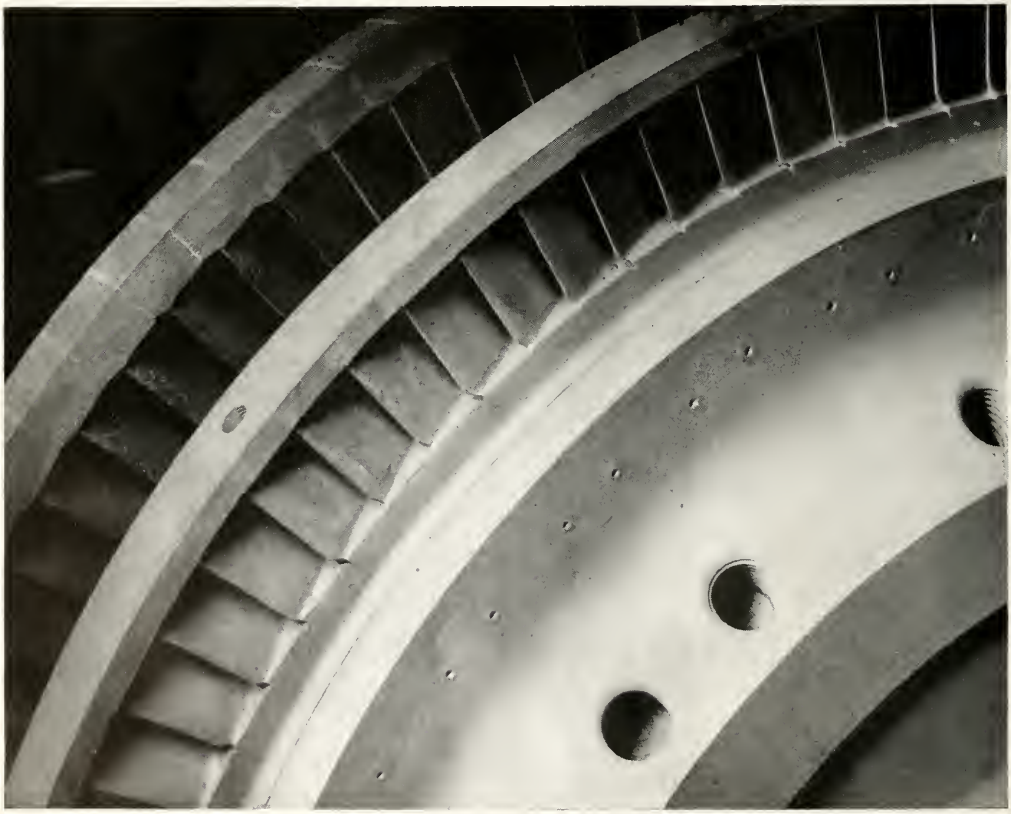
ADVANCEMENT IN TURBINES

When the need arises for stronger impulse blades for high-pressure steam turbines, designers will be ready. From the laboratory, complete with life tests, has come a new blade construction able to withstand duty much greater than present blades. In fact, to determine the strength limits of the new, pinned blade, a stronger test machine had first to be built.

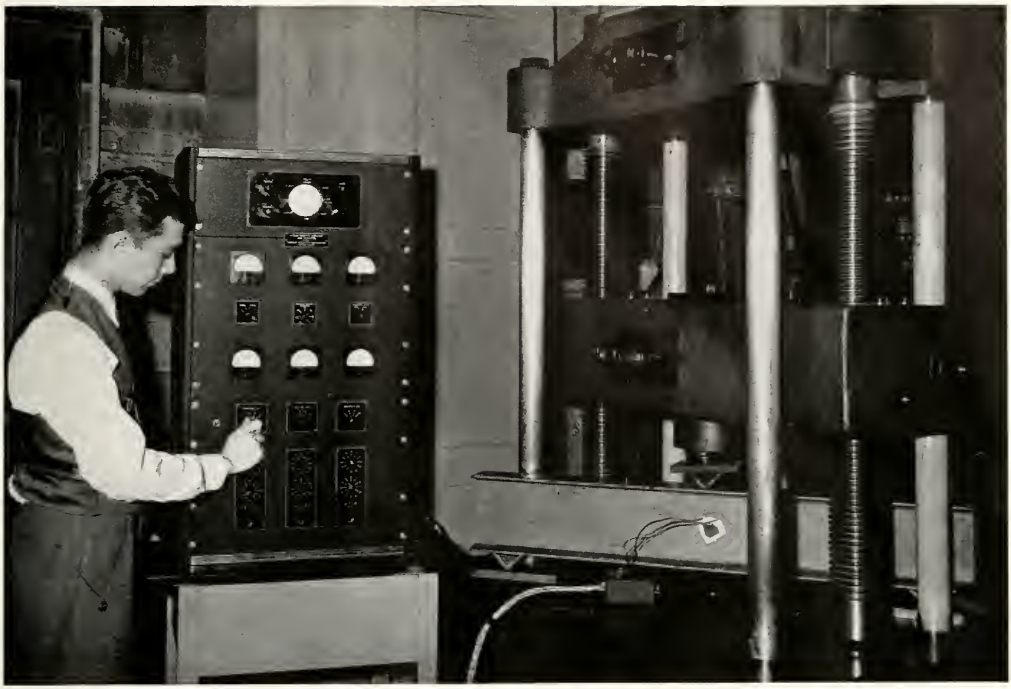
The root of each blade is shaped like an inverted U. Three blades are brazed together forming one solid segment, which fits into circumferential grooves in the spindle. With the segments in position, holes are drilled crosswise through the rotor and through edges of two adjoining segments. Pins are then driven through these holes and the ends peened. The result is a tightly locked structure in which the areas carrying stress are positively known, something not always possible with multiple-fit blades.

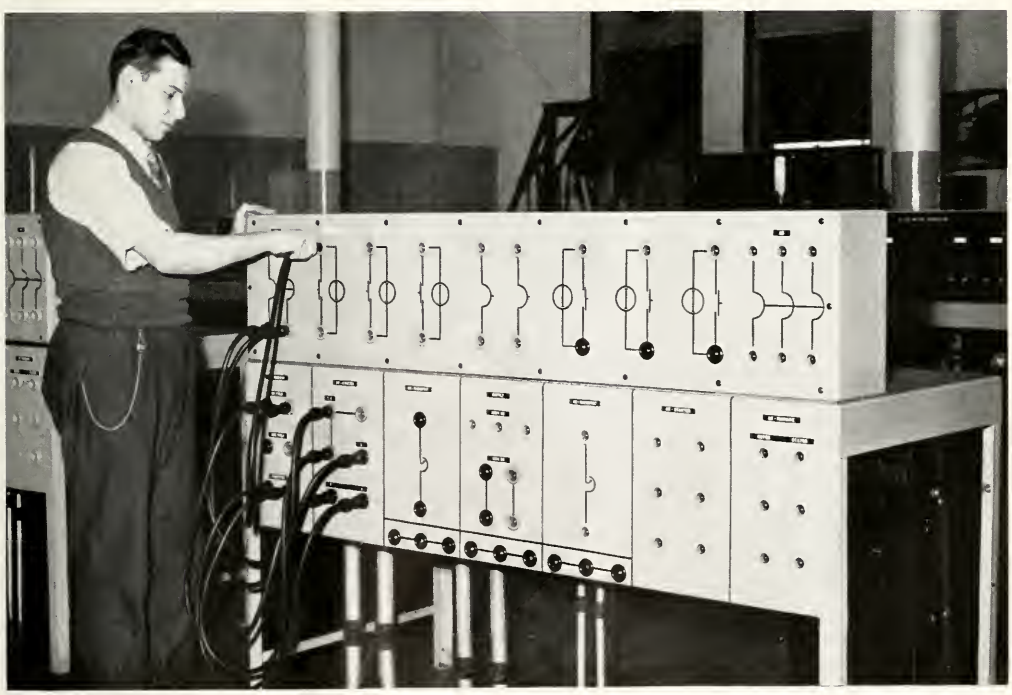
The new construction, in addition to its great strength, has other attractions. Any segment of three blades can be removed directly without disturbing any other segment. For the same steam-working area the blade is smaller. It is 1½ inches wide by 2 inches deep as compared with 2 by 3½ inches of the present multiple-fit blade. As a general principle, the narrower the blade for a given steam port height, the greater the efficiency possible.

The blade with a double-T root is giving a good account of itself under the severest conditions imposed on present-day units, but the new blade is ready for the day when greater steam loadings are imposed.



New Pinned Blade Segment Compared with Conventional Double-T Blade





In the top picture above is shown an electronic computer for strain rosettes which was erroneously labeled "Section of Electrical Machinery Laboratory Showing Switchboard" in the December issue. The electrical machinery laboratory switchboard is reproduced in the lower picture.

JET PROPULSION

(Continued from page 10)

approximately 17 feet, with a straight leading edge, tapering from 28-inch chord at the tip to 44 inches at the root. The wing is carried by a main spar, which consists of a simple steel tube. The ribs are pressed steel, and spot welding is employed where necessary; there are no ailerons. The fuel tank, located amidships, has a capacity of approximately 160 U. S. gallons, enough to keep the bomb flying for some 20 minutes. Immediately behind the fuel tank are two spherical air pressure tanks. These are apparently designed for high pressure, since they are wound with three layers of piano wire, and look much like a housewife's ball of yarn because of the manner the layers are criss-crossed. The air tanks are held in place by heavy straps, and immediately behind them is a single vertical heavy tube which supports the impulse motor.

The last portion of the fuselage is a conical piece which carries the control elements and the tail surfaces. The air pressure from the spherical tanks is used both to force the fuel into the impulse engine and to run the automatic pilot. The control of the bomb is exercised by several air driven gyros, one controlling the rudder in response to the indications of a magnetic compass in the nose of the bomb. The elevators are controlled by the second gyro, which apparently is in turn governed by a barometric capsule which can be pre-set for a given altitude. Pneumatic servo-mechanisms operate both rudder and elevator.

There is still some speculation as to the manner in which the flight distance is determined. Those on the receiving end of the bomb state that it flies along on its course at a speed in excess of 300 miles an hour until it reaches the point where it intends to spread destruction. The motor then cuts off, and the bomb dives to the ground. Some descriptions indicate that the dive is caused by "spoilers" which are hinged to the bottom rear edge of the stabilizer. These are apparently secured by a latch until at the proper time a spring releases them and at the same instant locks the elevators and the rudder. The spoilers are pulled down, and, being of different sizes, put the bomb into a diving spiral. Whatever the method of accomplishing the dive, observers are agreed that, when the motor stops, it is advisable to seek a bomb shelter, because a violently destructive explosion is certain to result within a relatively few seconds.

The impulse duct engine operates with high effectiveness and low (2 per cent) efficiency. It is charged with air by the ram effect produced by the velocity of the bomb, and, when the air pressure builds up to its maximum value, a liquid fuel such as kerosene is injected through a series of spray nozzles and electrically ignited. The rapid combustion raises the pressure in the chamber, closing the inlet valves, and causing the hot gas to puff out through the duct. As the gas leaves the duct, the pressure again falls below that produced by the forward velocity of the bomb, and the combustion chamber is recharged with air. Some 30 to 40 such explosions per second give the impulse engine an approximate rating of 600 horse power, and a speed variously estimated at 250 to 350 miles per hour. Its fuel consumption is many times as great as that of a conventional engine, but it needs only a low grade liquid fuel instead of high octane aviation gasoline.

The method of starting the buzz-bomb is also the subject of some conjecture. Apparently, they are launched from ramps which are 170 feet long, although the exact method of catapulting them into the air has not yet been explained. The impulse engine cannot operate at a speed lower than 150 miles per hour, but, once started, it will accelerate until it reaches a speed where the drag is just equal to its thrust. American engineers have reconstructed V-1, and apparently it is now under mass production for eventual use against Japan.

The future significance of V-1 as a military weapon has been the subject of some controversy. British authorities have stated that it represents a waste of time and effort which might better have been employed on more effective weapons. On the other hand, a leading American designer of military aircraft holds quite a different view. Peyton Magruder, chief of new design at the Glenn L. Martin company, feels that the robot bomb has great military possibilities. Since it is a one-flight pilotless ship, it can eliminate everything having to do with landing, and with protection of the pilot. Elimination of landing gear, ailerons and wing flaps and their control systems, as well as the omission of armament, results in a flying weapon which can be far more effective as a carrier of destruction than a conventional bomber.

The extremely high wing loading, 150 pounds per square foot, is about twice that of a conventional bomber. Since the robot has neither to maneuver or to land gently, it must have only a starting speed low enough to enable it to get into the air with reasonable assistance. Reduced wing area also reduces the total drag and the absence of a pilot enables the fuselage to be smaller in cross section and better streamlined. Approximately 500 robot bombs could be built for the cost of one four-motored bomber, and it does not require for its upkeep and repair a veritable army which must be trained, fed and housed. It does not need large hangars, airports, or extensive shops. The flying field with a two-mile runway can be replaced by a simple launching ramp.

The development of robot bombs which is certain to come is likely to eliminate their present difficulties. Their relatively short range and low speed can be overcome, and it is certain that radio directional control will cause it to be virtually as accurate as present bombing methods. In addition, adverse weather will favor instead of hinder the robot, since it will seek out its target without the necessity of human observers, while heavy fog or darkness of course prevents an unaided pilot of a pursuit plane from locating the bomb in order to destroy it in mid-air.

There has always been a defense for every new weapon which has ever been developed, and fortunately the defense against V-1 was ready when the attack came. Barrage balloons, specially built Bofors anti-aircraft guns, and extraordinarily alert fighter planes succeeded in accounting for about 70 per cent of the buzz-bombs which were launched. These measures, obviously, are useless against V-2. Defense against V-101 may well take the form of a pursuit robot with automatic radio controls which will cause it to seek out and destroy the invader. Naturally, to quote Mr. Magruder, the best counter measures will be provided by an organization of world security so that there need be no resort to such weapons.

While flying bombs and long range rockets have suddenly come upon a relatively unsuspecting world as military weapons, another application of jet propulsion has been brought to public attention through the announcement of the operation both by the Allies and the Nazis of jet-propelled aircraft. Although very little is known of the German planes of this character, enough has been published concerning the Allied developments to enable us to understand their method of operation, and to make some predictions concerning their future developments. Jet propulsion of military aircraft has been brought to the point where the British have at least one plane, the Gloucester, which is now in military action, while we also have

Lessons Learned

by The Dow Chemical Company for the advancement of industry

College students majoring in chemistry and other technical subjects find special interest in Dow developments. Here are some of the things Dow has learned how to do as producer of more than 500 chemicals essential to industry:

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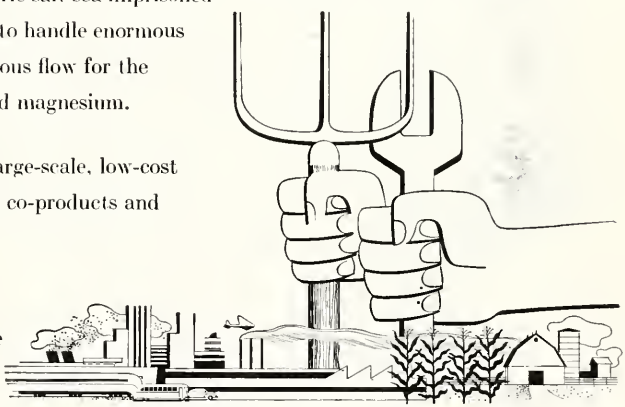

How to develop original processes for large-scale, low-cost production of these chemicals, their co-products and related materials.

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Amazing story of a "laboratory curiosity" that became an Industrial Giant!

ONE OF THE GREAT miracles of this war—the rapid expansion of U.S. airpower—was performed with the help of a huge electronic device—the *Allis-Chalmers Mercury Arc Rectifier!*

First introduced to America in practicable form by Allis-Chalmers, the Mercury Arc Rectifier provided—in the nick of time—a fast, easy way to convert alternating to direct current for mass production of aluminum and magnesium for warplanes.

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Better Pulpwood, More of It—With Less Manpower! Important help in reducing serious manpower shortages in the nation's pulp and paper industry is Allis-Chalmers' new Streambarker...a machine which removes bark from pulpwood logs quickly, thoroughly, economically by means of water under high pressure.

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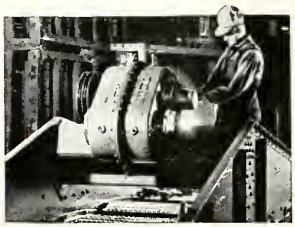
More Help for "Sink-Float" Plants: To facilitate wet screening and dewatering, Allis-Chalmers has designed a new End-Tension Deck for Low-Head Vibrating Screens.



New deck construction assures uniform depth of product and maximum use of screen surface for more efficient operation. Write for Bulletin B-6321.

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TUNE IN THE BOSTON SYMPHONY—

Allis-Chalmers' coast-to-coast radio program dedicated to the men and women of American Industry!

Hear the World's Finest Music by the World's Finest Concert Orchestra with Serge Koussevitzky conducting. Over the Blue Network, every Saturday, 8:30—9:30 P.M. (E.W.T.)

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the Bell P59-A Airacomet which is powered by two General Electric turbo-jet units.

Continuous jet propulsion units have been under development for many years, and it is difficult to give the credit for their invention to any single individual. However, the names of Air Commodore Frank Whittle and Sanford Moss. *General Electric engineer emeritus,* rank high in any such history. The principal problem in the jet propulsion of aircraft has been the provision of some method of continuously compressing air to a moderate degree so that, by the burning of a fuel with that air, an adequate jet could be produced. This problem was solved through the labors of Dr. Moss, whose work in the field of gas turbines dates back to his student days at Cornell university.

Production of power by direct action of combustion products upon a turbine wheel has been an engineering dream for a century and a half. Scores of patents were issued during the last century, but no inventor succeeded in overcoming the apparently insuperable problem of producing a compressor-turbine combination high enough in efficiency to allow the generation of sufficient power from the turbine wheel to keep the compressor and the fuel pump in continuous operation. The thermodynamics of this cycle were well understood, and it was realized that without such a combination, and in the absence of metals which could withstand continuous temperatures far above 1000F, a gas turbine was beyond the realm of possibility.

Dr. Moss, during World War I, turned his attention to the development of a sorely needed device for supercharging aircraft engines. He succeeded in developing a simple but effective turbo-supercharger, in which the exhaust gas from an aircraft engine, flowing through a simple impulse turbine wheel, produced enough work to drive the supercharger impeller. This device, first assembled in May, 1918, and perfected in the ensuing years of uneasy peace, enables the United States to construct aircraft which can fly successfully at altitudes far above those which are attainable without such a supercharger.

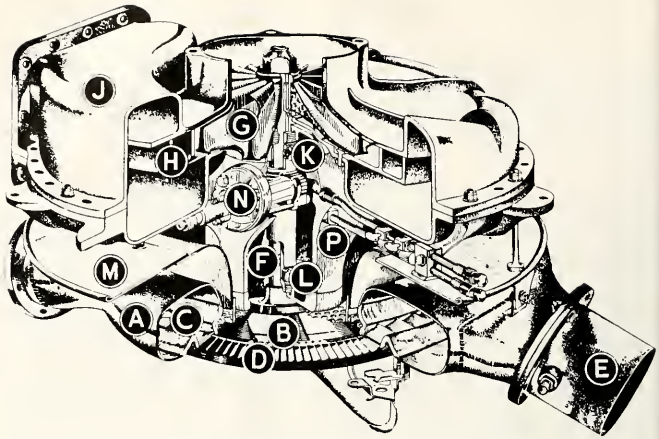


Fig. 9. The Moss Turbo-Supercharger

The Moss turbo-superchargers, Fig. 9, constructed in vast numbers by the General Electric company and the Allis-Chalmers company, have played a tremendously important part in World War II, and they are largely responsible for the vast forward strides which have been made during this war in the design of high altitude bombers and fighters. For example, the B-29 uses two turbo-superchargers on each of its four engines. The Thunderbolt P-47 Fighter uses one supercharger, located behind the pilot in such a way that he is virtually surrounded by duct work which leads the compressed air from the supercharger to the engine intake. When it is realized that, at top altitude, the air intake of the supercharger operates at —70F, while the turbine portion operates at about 1500F, some appreciation may be gained of the engineering

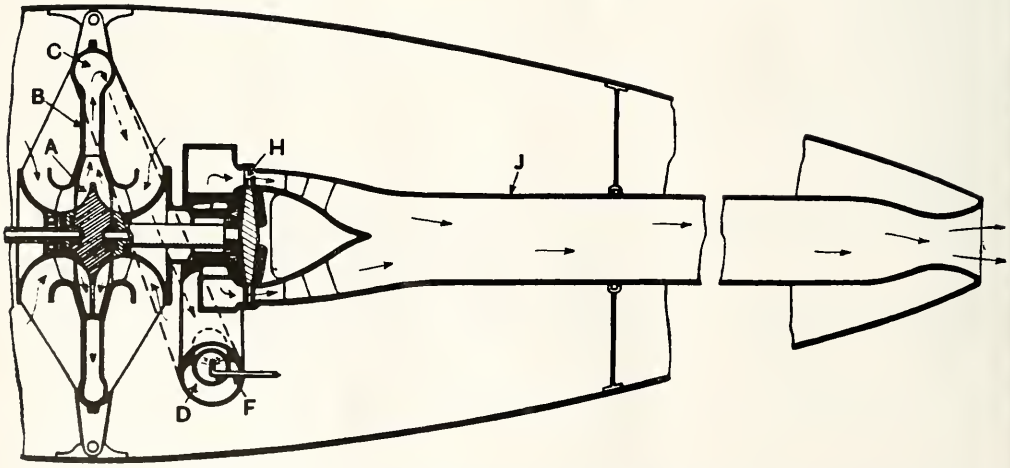


Fig. 10. The Whittle Turbo-Jet System. Air is compressed, heated by burning liquid fuel, expanded through a turbine, and exhausted through the jet

Fighting moisture and fungus–

communication's jungle enemies

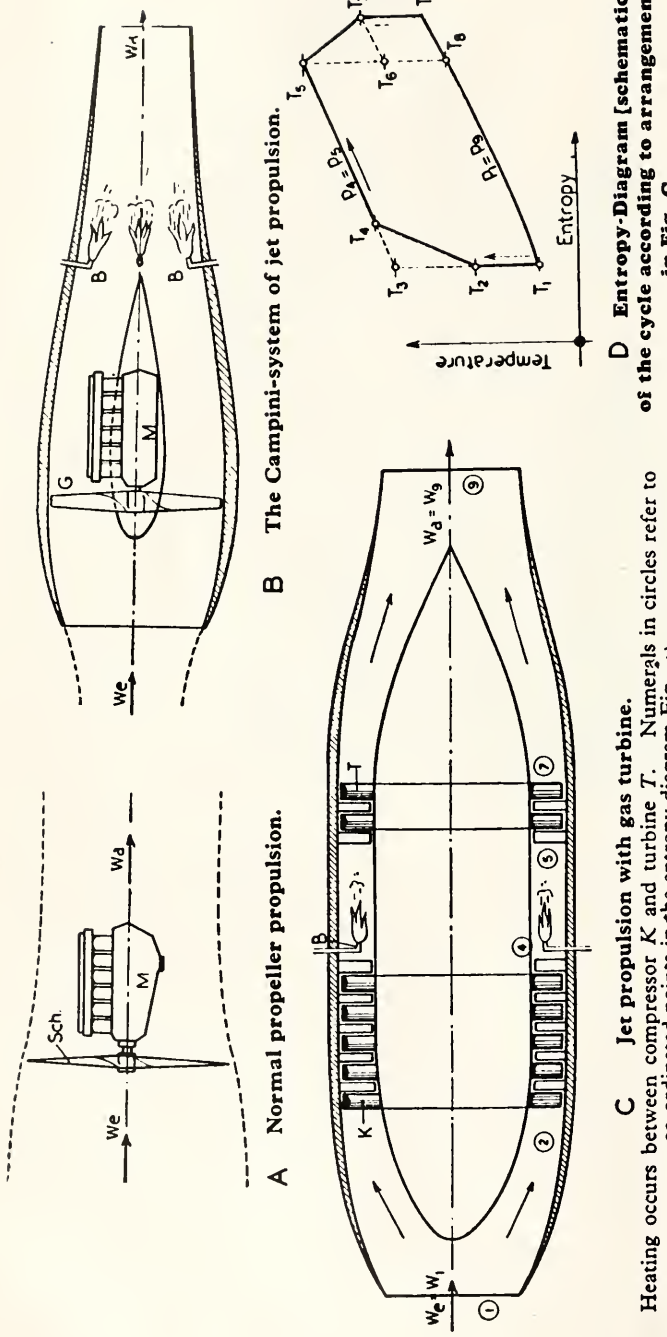
Ever-present dangers to military communications are the twin enemies of the jungle—moisture and fungus. By impairing the efficient working of telephones and radios, they can halt vital messages as effectively as cutting the wires.

The long experience of Bell Laboratories engineers in designing telephone equipment for use under all climatic conditions has helped the Signal Corps counter-attack these jungle enemies.

Lessons learned in this wartime emergency will aid in building better communications equipment for war and peace.

BELL TELEPHONE SYSTEM

"Service to the Nation in Peace and War"



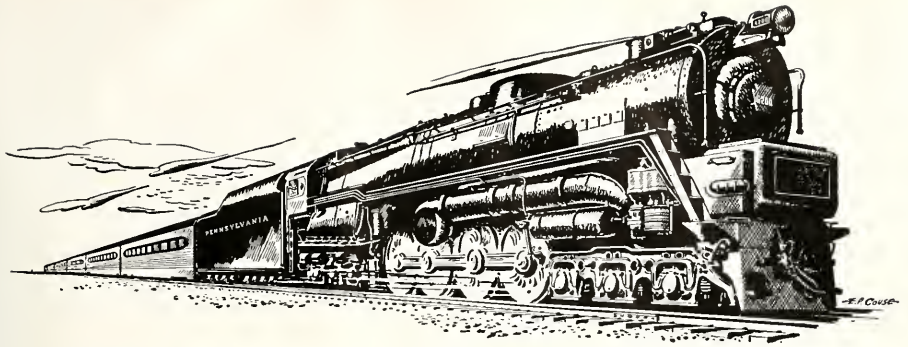
and metallurgical problems which are involved.

The first public flight of a jet-propelled aircraft apparently took place from Forlanini airdrome near Milan on August 27, 1940. Secundo Campini, employed by the famed Caproni aircraft company, constructed a ship which combined an engine-driven shrouded propellor with jet propulsion (Fig. 11B), and his CC-1 was apparently the first jet-plane to fly. His second ship, the CC-2, weighed 11,000 lbs., and included an additional seat for a passenger. On November 30, 1941, the CC-2 made a flight from Rome to Milan with an average speed of 130 miles per hour. This plane used an Isotta Fraschini radial engine mounted within the fuselage to drive an air compressor which produced the jet. No further developments along this line have been reported, and, in view of the success of the turbine-driven systems of jet propulsion, it is unlikely that the Campini system will receive much attention in the future.

Credit for contemporary jet-propelled aircraft should be given to Frank Whittle, an English engineer, who joined the Royal Air Force in 1926. In 1930, when he attained the rank of group captain, he received his first patent on a jet propulsion system for aircraft. Between 1931 and 1936, he engaged in further study of turbo-compressors and superchargers with the General Electric company's English affiliate, the British Thompson Houston company, and attended Cambridge university. After graduating in mechanical engineering with high honors in 1936, he returned to active duty with the R.A.F. Again conferring with engineers of British Thompson Houston, who had by that time gained hard earned experience in the operation of a steam turbine with an initial temperature of 1000F, Whittle laid before them a practical plan for a jet propelled aircraft. Construction of a jet propulsion unit was begun, and General Electric built the turbine for the test unit. The Gloster aircraft company designed a single seat monoplane for use with the Whipple turbo-jet propulsion unit, and the first successful flight was made in May, 1941, with Flight Lt. P. G. Sayers at the controls.

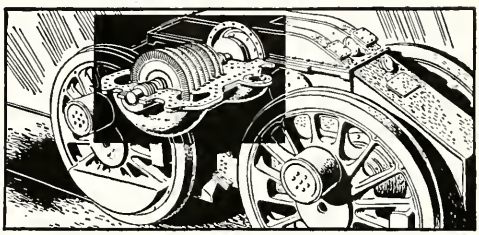
Although the details of construction of the British jet plane, and the Amer-

Fig. 11. Three Methods of Aircraft Propulsion (Courtesy of the ENGINEERS' DIGEST, Sept. 1944)

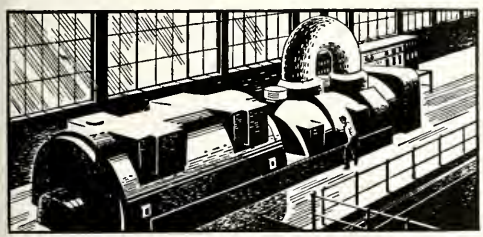


This Newest Locomotive
is Powered Like a Battleship

LONG AGO successfully developed by Westinghouse for ocean vessels, the *steam turbine* has now been harnessed as a brand new type of smooth, efficient motive power for modern railroad locomotives.



THE WESTINGHOUSE steam turbine in the Pennsylvania Railroad's new direct-drive locomotive is *no bigger* than a household electric refrigerator—yet it will haul long passenger trains with ease.



THE POWER-PACKED locomotive turbine is a descendant of giant Westinghouse turbines which generate much of the electricity used today. The great expansion of electric power began with these turbines.

THE VELVETY FLOW of power from this 6,900 horsepower *steam turbine* locomotive will make trains run with extra smoothness and is a major contribution to finer transportation for the future.

THE RAILROADS are developing a dazzling new kind of transportation for the future. The latest and most dramatic improvement is *steam turbine* power, which gives the Iron Horse "new lungs."

To help produce this new locomotive, the Pennsylvania Railroad, a long-time pioneer in transportation improvements, turned to Westinghouse and the Baldwin Locomotive Works. Working as a team, these companies have produced this latest in a great line of steam locomotives—descended from "Old Ironsides," built by Matthias Baldwin in 1832. *Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pennsylvania.*

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lean P-59-A, have not been made public, enough information has been given in patent literature and in press releases to enable those skilled in the art of turbine construction and thermodynamic calculations to comprehend the principles and possibilities of the Whittle system. Its simplicity is disarming, and the uninitiated, before saying "Why was that not accomplished 20 years earlier?" must realize that without the pioneering research of Dr. Moss and his contemporaries, Whittle could not have constructed a turbo-jet unit with any hope of success.

The Whittle system consists of a centrifugal compressor, similar in principle to the Moss supercharger, which takes in air, Fig. 10, from an air scoop at the compressor inlet A, and compresses it to a moderate pressure, discharging it into an elementary combustion chamber D. The hot products of combustion pass through a single stage turbine at H, doing enough work to drive the compressor, and leaving the turbine at high velocity through the outlet pipe J, producing the thrust necessary to push the plane. In its simplicity, this device approaches the German buzz-bomb, but, in its possibilities for continuous and eventually efficient operation, it far surpasses that destructive device.

An analysis of the three possible means of continuously propelling an airplane can be given with the aid of Fig. 11. A shows the normal propeller and internal combustion engine combination. Up to the present time, this method has been almost universally adopted. For speeds which have heretofore been considered adequate, the engine-driven propeller is the most effective way of driving an airplane and, for efficiency, range, and reliability, it represents a high tribute to the ability of engine and propeller designers. However, the latest models produced by American builders of radial aircraft engines are apparently approaching the top limit in compact power generating units, and it is difficult to see how much greater power or high efficiency can be expected in the near future. Likewise, the propeller imposes a very severe limitation. Although its efficiency is good at low speeds, as the speed of the plane approaches the velocity of sound, Fig. 12, the propeller efficiency drops off rapidly, and, for speeds above 500 miles an hour, the propeller does not offer much hope as a driving means.

The Campini system shown in Fig. 11, B, places the propeller in a duct, thereby aiding its efficiency to some extent, but the driving engine adds weight to an undesirable extent. The

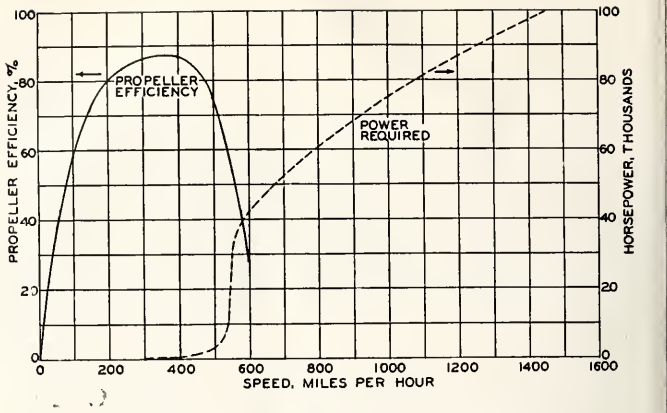

Fig. 12. Variation with Airspeed of Propellor Efficiency and Power Requirement (20,000 lb. aircraft, 40,000 altitude)

burners at B introduce the fuel which aids in giving a high jet velocity, and, as history has shown, a plane powered with this device will actually fly. The Whittle system, Fig. 11, C, has far more promise, because of its light weight and larger potential power.

The mathematics of jet propulsion are relatively simple, and the serious student of the subject is well advised to procure a copy of "The Modern Gas Turbine" by R. T. Sawyer of the American Locomotive company, where a comprehensive analysis of jet propulsion is given. His presentation of the subject is based upon that given earlier by the eminent English authority, G. Geoffrey Smith, managing editor of "Flight." He points out that the turbo-jet propulsion unit as a military device will undoubtedly be valuable, but the inherently low efficiency of moderate speed jet planes makes it unlikely that commercial applications of the simple Whittle turbo-jet system will be extensive. However, it is apparent that the addition of a propeller, driven by the shaft on which the turbine and the compressor impeller are mounted, represents a very impressive possibility. The gas turbine is rapidly emerging as a practical device for the production of power in amounts considerably greater than that which can be achieved by a convential aircraft engine. By utilizing the propeller at lower speeds, aided by the jet, and by the propulsive effort of the jet alone at very high speeds, we approach a motive power unit which can tremendously increase the scope of flight. The gas turbine alone can already produce a very reasonable efficiency, and as metallurgical developments enable the operating temperature to be raised, its efficiency will also increase. The extremely low weight per horse power, which is made possible by a gas turbine-compressor combination rotating at a speed in excess of 10,000 RPM, gives very interesting possibilities as a propulsion unit for the aircraft of the future.

Other combinations, which for reasons of national security cannot be disclosed now, make the turbo-jet propeller system very attractive indeed, and give promise that the leviathans of the air, now appearing in the advertising dreams of post-war minded manufacturers, may be within the realm of accomplishment.

As we look forward to the future of air travel, it is well to contemplate the realities of high speed flight. V-2 can achieve the almost unbelievable speed of 3,000 miles per hour, because it is a low resistance projectile, and, in their eagerness to launch destruction upon their enemy, the Germans have been most prodigal in their use of fuel. However, if we want to fly with anything resembling a conventional aircraft, and particularly one which we can conceivably land after it has once been launched, we must realize that its power requirements are going to be extremely high. Fig. 12, which is adapted from a very ingenious chart prepared by the Douglas Aircraft Company, indicates that speeds up to 500 miles per hour are relatively easy to achieve. For example, a 20,000 pound aircraft of conventional design, flying at the moderate altitude of 40,000 feet, would require approximately 5,000 horse power at a speed of 500 miles per hour. At this speed, a propeller of modern design could achieve an efficiency of approximately 80 per cent. In order to increase the speed to 600

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They see what human eyes have never seen before!

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PIONEERS IN PROGRESS

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miles per hour, the power must be increased to 42,000 horse power and the propeller efficiency will have dropped off to almost nothing. Thus, it appears that level flight of a conventional plane at 600 miles per hour is not likely to be achieved in the immediate future. If, in some imaginary future conflict, we should set out to overtake a relatively slow moving long range rocket at, for example, 1000 miles per hour, we would have to expend 100,000 horse power unless we could devise some means of drastically reducing the drag of our aircraft. This is also pre-supposing that we can devise wings which would produce any lift at all at such a speed.

In summary, the use of rocket motors which carry their own fuel and are accordingly independent of atmosphere is the only means now conceivable by which flight beyond the earth's atmosphere can be accomplished. Likewise, such devices, as exemplified by V-2, can achieve velocities ten times as great as those now in use by commercial and military aircraft. However, the fact that such units must utilize their fuel at prodigious rates appears now to limit their usefulness to military or other non-passenger carrying situations. The development of robot bombs, propelled by jets, and guided to their destination by radio controlled devices, may be expected to have important military consequences.

The use of the turbo-jet system, as exemplified by our P-59-A (Fig. 13) and the Nazi M-262, may be expected for military aircraft of the attack and pursuit variety, since present day aircraft of this type, powered by conventional engines, also are limited in their flight time and range.

For the propulsion of tremendous transcontinental and transoceanic aircraft, dwarfing in size even the gargantuan Martin Mars, we may expect to see the development of gas turbine propulsion units, which will drive propellers for take off and low speed operation and which will supply the energy for jet propulsion at higher speeds. Sustained flights at speeds greater than 600 miles per hour will probably require such a tremendous expenditure in fuel that we can hardly expect such speeds for normal operation within the next generation.

In conclusion, it should be emphasized that unceasing research must be carried on so that the United States will never lag behind any other nation in the development of aerial transportation. The engineering advances made in this field during the past generation reflect vast credit upon the pioneers who have been responsible for this progress. If those who inhabit the earth can learn to live in peace, the airplane can tremendously enrich their lives. If they cannot learn to live in peace, the airplane and its cousins, the various flying bombs, will effectively accelerate their inevitable extinction.

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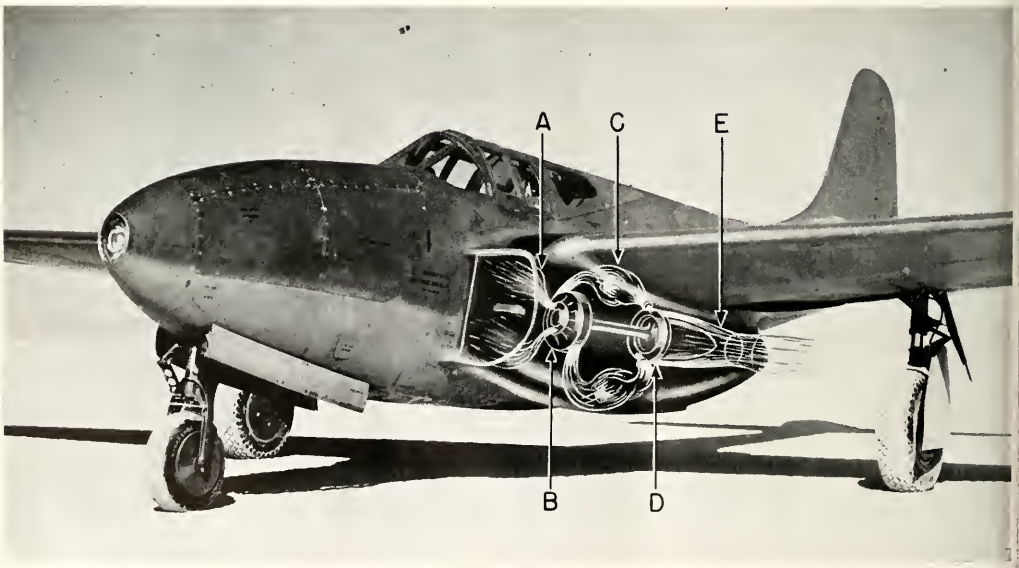
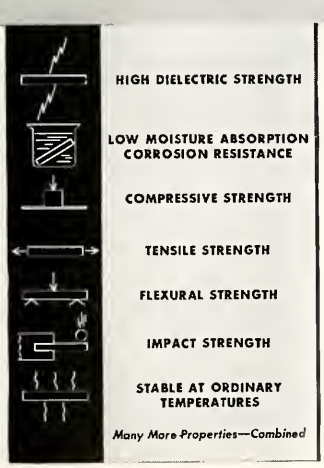


Fig. 13. The Bell P-59-A "Airacomet", Powered by Two General Electric Turbo-Jet Units

When Watt Asked why, Steam went to Work



STEAM jiggled the lid of many a kettle before James Watt asked why . . . and went on to make steam work an engine that helped touch off the Industrial Revolution.

Plastics provide similar opportunities for investigation.

Possibly you haven't used plastics for as many applications as you profitably might. Perhaps you haven't looked into plastics at all . . . but should. So, a suggestion: If you, with your first-hand knowledge of the properties you need in a material, will tell us what your physical, chemical, electrical, or mechanical requirements are, we will quickly see whether our type of technical plastics can help you in any of your current or future applications.

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(Continued from page 21)

tion is jointly supervised by Dr. J. J. S. Sebastian, who received his chemical engineering degree from the Royal Polytechnic Institute, 1922, and his doctorate at Carnegie Institute of Technology in 1935, and by Mr. A. D. Singh, who received the degree of B.S. and M.S. from the University of Illinois.

The scope of the research work under way at the Institute has expanded tremendously during the past year. Increased emphasis has been given to basic work in the field of gas production, and a comprehensive program of research on the problems confronting the manufactured gas industry has been proposed to the appropriate committee in the American Gas Association. Work on the problems of the the natural gas industry is also going forward in several directions. A new method of storing natural gas in the form of hydrates is being actively studied, and the first publication in this field is expected shortly. Particular aspects of the Fisher-Tropsch synthesis are also being investigated with encouraging results.

One of the outstanding contributions of the Institute during the past year has been the invention of a new method of pulverizing mineral materials, which constitutes an extension of the method originated several years ago by Dr. Francis Godwin of the Armour Research Foundation. The Gas Institute's process can pulverize mineral material ranging from limestone to coke breeze and it is being vigorously developed for future application to gas generation processes.

Work has been undertaken during the past year for a number of member companies, and an increasingly wide variety of problems now find their way to the Institute. Several new projects related to national defense have recently been established.

Of great importance in the program of the Institute is the gas industry development program, now getting under way for the American Gas Association as a result of the outstanding work done by Mr. Ernest Acker, president of the Central Hudson Gas and Electric company, and the past president of the A.G.A. The gas industry is planning to spend well over one million dollars per year for the next three years in an effort to apply research to the problems of both the natural and manufactured branches of the industry, and to improve the competitive position of the gas industry as compared with other sources of energy. Research on gas generation will be the responsibility of the Gas Production Research committee, headed by Mr. P. T. Dashiell of the Philadelphia Gas Works, and composed of outstanding gas production men from leading companies. This committee visited the Institute on December 19, and a complete report on the current research activities was given to them. In addition, the Institute presented a comprehensive program of research, and implemented that program by a group of specific recommendations for research projects. Several of these have already been awarded to the Institute, and work is now under way.

The budget of the Institute for the current year exceeds $300,000, a growth of almost 100 per cent from its first year of operation. The staff numbers about 60, and is being increased as rapidly as competent young scientists can be located. As is appropriate for the youngest member of a family, the Gas Institute has grown rapidly, and continued growth can be confidently expected.

FELLOWSHIP

(Continued from page 23)

research on the network calculator. The fellow's third term will be devoted primarily to the research investigation.

Under the plan outlined, it is hoped to undertake research that is of vital importance to the industry. The plan will have the advantage of offering a certain amount of background training in the field before research is begun. Close cooperation with engineering practices in industry will permit the fellow to become acquainted with developments in the field. Contact with the network calculator operator and with others making studies on the board should be of great value in acquainting him with practical problems of operation and design.

In taking his training at Illinois Tech, the holder of the fellowship will have the advantage of working with the newly purchased network calculator and other comparable equipment. The department, now headed by Dr. Louis T. Rader is also fortunate in having a staff that combines training with practical experience.

Dr. Hobson who arranged for the purchase by Illinois Tech of the $80,000 Westinghouse network calculator, which will make possible a large part of the training for the holder of the fellowship, also set up a program of graduate study in engineering at Allis-Chalmers in Milwaukee which is expected to pave the way for many other progressive ventures in cooperation between industry and engineering colleges after the war.

With bachelor's and master's degrees from Purdue, Dr. Hobson received his doctorate, magna cum laude, from California Institute of Technology in 1935. Five years later, while working for Westinghouse, he was chosen as the outstanding young electrical engineer of the nation by Eta Kappa Nu, national honorary fraternity.

In 1937 he came to the central station section of the industry engineering department at Westinghouse. From 1938 to 1941 he held the position of central station engineer at the Northwestern District headquarters, where he had charge of the consulting service provided for customers' engineers. In this capacity he worked on the coordination of equipment and the solution of analytical problems.

Illinois Tech in 1941 offered him the directorship of its electrical engineering department. Last November Dr. Hobson became director of Illinois Tech's Armour Research

(Continued on page 60)

(Continued from page 12)

started right or wrong, you may become either a real engineer or a "handbook engineer." A handbook becomes a wonderful asset if it is rightly used, but it becomes a snare when it is given too important a place in your library.

Of course you cannot expect to remember every formula and every accepted rule of enginering. There are just too many. So you keep a handbook handy to pick out the formula, rule, equation, or curve when and as you need it. Now here is the catch question: If you are going to use the handbook anyway, why bother to derive the formulas or plot the curves in the first place? Can't you just become familiar with the authoritative sources of material and then assemble and use these data when the need arises? The answer is NO! That is handbook engineering and it has been proved to be too dangerous to encourage. Engineering is not a series of convenient pigeonholes from which you pluck facts and figures that apply directly to the problem before you. The same problem seldom occurs twice.

When you start to study technology, you are likely to feel that anything in print is bound to be right and that every author is an authority. A halo often seems to fall upon the brow of the writer; we are likely to assume that he never makes mistakes. But the fact is that there are very few books without errors, and an error or confused statement every few pages is common in technical books. Most of these errors are not very important, but some of them are completely misleading. In reading books the critic does not always find all the errors. If you should read the same book, you might find others. The point is that you cannot afford to accept anything you read until you have checked it.

Mathematics—The Universal Tool

Without mathematics engineering could not have developed much beyond its status in the ancient world. More and more the problems faced by the engineer cannot be solved without mathematical tools. However, there are two sides to engineering, art and science, which are equally important. Modern emphasis upon mathematics is simply a compensation for the over-emphasis upon the art side of engineering that existed in the past. Construction, for example, must always remain largely an art, but analysis and design are becoming progressively more scientific.

Hypotheses, upon which much engineering science depends, are not subject to logical or mathematical proof but are justified by observation and experiment as the starting points for theoretical derivations. Keep in mind, nevertheless, that mathematical transformations applied to a starting hypothesis produce formulas that are no more applicable, exact, or rigorous than the original assumption or hypothesis. Mathematics adds no authority to the final results — it merely transforms our stated hypothesis into equations, formulas, or graphs for convenient use.

As a matter of special interest, you will want to know that the engineer has several devices that help him find a simple mathematical solution. First, he usually can nearly guess the answer, so he can often work backwards to help simplify the mathematics, and his knowledge of the answer is always one way of checking the result. Then, too, his understanding of the engineering problem often leads him to expect to need a certain kind of mathematics for the solution.

Physics as a Background

Closely related to mathematics, the second great tool of the engineer is his knowledge of physics. Mathe-

Keeping Navy searchlight reflectors spotlessly clean is an unending job. The Haynes Stellite alloy, from which many reflectors are made, is so hard that constant cleaning and polishing will not mar its surface.

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UNCLE SAM'S NAVY has the most efficient searchlights on the Seven Seas. They are so powerful that one of them measuring 24 inches across can shoot a beam of light through 23 miles of inky darkness.

The reflectors of these searchlights are made of an alloy perfected and produced by HAYNES STELLITE COMPANY, a Unit of UCC.

The Navy is using this Haynes Stellite alloy for several reasons. It will not shatter from shock of gunfire. It has high resistance to corrosion by salt air, salt spray, powder and sulfur fumes. It withstands the terrific heat of the arc light—and hot particles of copper and carbon from the electrodes do not cause it to pit and lose its reflectivity. Searchlight reflectors are indicative of the many applications to which Haynes Stellite alloys—with their unique combinations of properties—can bring more efficient performance.

Haynes Stellite alloys have long been used for scientific mirrors, surgical and dental instruments and other equipment requiring great resistance to corrosion, wear and heat. Unending research by UCC is constantly adding to the variety of these alloys. They can be produced in many exacting shapes—in quantity—and delivered ready for assembly without further finishing.

Consulting engineers, production managers, educators and designers are invited to send for booklet P-3 describing the properties of Haynes Stellite alloys.

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matics is a theoretical subject; physics introduces theory to laboratory experiment. The physicist tries to explain the things he sees in nature, using mathematics and his ability to experiment in his laboratory. Everyone knows the story of Newton's interest in falling objects which led after years of study to his theory of gravitation. Einstein found that Newton's theory did not explain some movements of the planets, which led him to devise his theory of relativity. Here as in most of the physicist's work, we find tied together (a) an unexplained phenomenon of nature, (b) a controlled experiment for study of the observed phenomenon, (c) the devising of a mathematical theory that explains the phenomenon.

Chemistry and Chemical Engineering

In continually greater measure, chemistry is laying the foundations for new industries. Organic chemistry, in particular, seems to be developing rapidly. Synthetic materials stimulated by the war will continue to be produced in greater and greater quantities. Of these, the organic plastics have attracted the greatest popular attention. The thrill we get out of the development of plastics is difficult for the chemist to understand. He had known about the basic kinds of plastic materials for a generation—some were developed almost a century ago. Our interest in them is largely an economic one. Through a long depression from 1930 to 1937, we waited hopefully for the new industry that failed to come to our economic rescue. Then about 1938 we became aware that the new plastics industry was already here and PLASTICS became a word with which to conjure.

It is often difficult to distinguish between chemistry and chemical engineering. The subject of plastics production will serve as an example. The job of the research chemist is to experiment with the raw materials available to find out what kinds of plastic materials can be produced and to iron out all difficulties inherent in the chemical reactions involved. It is then the function of the chemical engineer to take over and commercialize the process. The engineer must not only design a plant to produce the plastic material on a large scale, but he must also be certain that the resulting plastic molding powder can be sold profitably on a highly competitive market. Of course, some chemists are also able to commercialize their research developments, and some chemical engineers direct research, so that the fields are inter-

Glass like ribbon candy...

"WHAT do you think of this?" said the research physicist, hauling out a long wide flexible ribbon of glass as thin as paper. He shook it and it bent and rattled like rain on a roof.

"What's it for?" said the fellow who writes these ads. "Well," said the physicist, "it may have a lot of uses. We haven't had time to explore them all yet. But one we've already found is in wartime radio equipment."

This interesting new type of glass is just one of the many contributions of glass research to the war. For the glass industry has thrown its entire accumulated experience, engineering and research facilities, into the job of putting glass on the fighting and industrial fronts where it can hurt our enemies most.

War and Corning research have put glass in a lot of strange places. For instance, there was a time when almost all piping in chemical plants was alloy of one kind or another. Now chemical people have discovered that glass piping is better for many purposes, and Corning has even developed a method for welding it into continuous lengths.

What about the business *you* choose to follow? Perhaps someday glass can replace metals, speed production, improve products for you. It has for others, and Corning knows how to apply glass to many different problems. Keep it in mind. Corning Glass Works, Corning, N. Y.

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woven, but the common division of duties is as indicated.

Civil Engineering

On November 7, 1940, newspaper extras all over the country headlined the collapse of the world's third longest bridge—the Tacoma Narrows Bridge. To the public this was probably the most spectacular set of pictures in a decade; to the engineer the newsreel of that disaster has become a scientific record of the greatest significance. Great popular interest was stimulated and the structural engineer for a short time became a public figure criticized and held in awe. Certainly, after seeing the moving pictures of that writhing, tossing monster, equal in over-all length to a half-dozen battleships, people began to realize the tremendous responsibilities involved in the engineer's job of "controlling the forces of nature."

The Tacoma bridge was by far the most flexible long-span bridge ever constructed. Its collapse was the third major bridge disaster of this century. This bridge was amply strong to resist all loads but its tendency to oscillate under the influence of wind gusts caused its failure. Its shallow stiffening girder and its narrow roadway combined to produce little resistance to twisting action.

In the failure of the Tacoma bridge you have seen some of the problems faced by the structural engineer. He also designs and constructs buildings in steel and concrete, dams, docks, hangars, and every type of structure needed by industry. The highway engineer lays out and builds roads, streets, and airports. The hydraulic engineer designs irrigation systems, levees, and other flood-control projects. The sanitary engineer is responsible for water supply and sewage disposal and also for the treatment of industrial wastes. The municipal engineer acts as a city manager. The foundation expert is much needed for the design of deep piers, footings on troublesome soil, and underwater construction. These are the divisions of civil engineering and, in the main, they are involved with public works. More than any other, the civil engineer works directly in the interest of the public.

Mechanical and Aeronautical Engineering

The mechanical and aeronautical engineers deal with fast-moving reciprocating machinery. The hydraulic engineer may have to plan the design of a hydraulic turbine and the electric engineer does design electric motors, but both depend upon the mechanical engineer to design the bearings, the system of lubrication, and the general structure of the machine, based upon the strength of the materials to be used.

Of course, the airplane engine is a natural field of study for the mechanical engineer. The plane itself is a structure rather than a machine since it does not have rapidly moving parts but moves as a whole. Its design is similar to the design of a bridge truss; like the bridge, it carries its own weight and the weight of its cargo.

There are many other fields of mechanical engineering. The steam-power engineer deals mainly with large power plants. The internal-combustion expert or diesel engineer faces many problems with his engines for automobiles, airplanes, ships, streamlined trains, and small power plants. Air conditioning, which today includes heating, ventilating, humidifying, cleaning, cooling, and purifying air for any building, is an active field for study. Refrigeration engineering is important in the storing, preserving, and transporting of foods. And, of course, we must not forget the production engineer, usually of mechanical-industrial training, whose job it is to keep the machines

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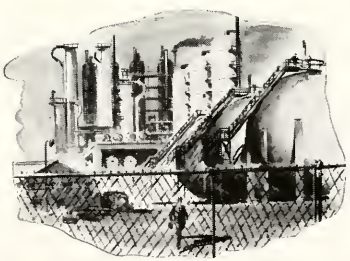

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of industry continually at work turning out goods by mass production. Years ago he was the unwanted "efficiency expert," but today he is accepted and respected in every progressive industry.

Electrical and Communication Engineering

The most important engineering advancement of the past half-century has been the development of electric power. The electrical power engineer may be concerned with electric power generation but, he may also be interested in electric power transmission or in the design and application of the necessary equipment for transmission, such as transformers, power lines, or lightning protection devices. High-voltage and hydropower generation represent other specialized power fields. Power-consumption devices, from industrial motors to home vacuum sweepers, provide jobs for many electrical engineers.

When DeForest began to experiment with radio transmission by use of the vacuum tube (1906) he opened up another field for the electrical engineer that may well become equal in importance to the electric power field. The magic radio of 1920 became the public's darling by 1930 and the widest form of popular entertainment by 1940. Television was nearly ready for commercialization by 1937. The academic interest in extremely high frequencies led to the highly secret radar which the army took over for the development of detection devices.

Its success in these three fields leads us to conclude that the electronic tube has an important industrial future. Communication or industrial electronic engineers will be needed to devise, install, and operate electronic controls for automatic industrial machinery, for medical and also industrial heating devices, and for dozens of uses not yet imagined. The development of vacuum-tube devices has passed out of the stage of gadgeteering, and it is not likely that major contributions to the field of industrial electronics will be made from now on by the inventor without technical education.

Special Fields of Engineering

In twenty years, from 1929 to 1940, the alloys of iron and steel increased a hundredfold in number. Following enormously increased war production, aluminum and magnesium may be expected again to drop sharply in cost and to compete on a peace-time basis with steel possibly even for bridge and building construction. Rarer metals such as tungsten, vanadium, and molybdenum have become common or at least less rare, and have contributed greatly to technology for particular uses or as alloying metals. With all these developments in the air, it is small wonder that metallurgy has attained the status of a special field of engineering. Metallurgical engineering was long considered a branch of chemical or mechanical engineering. The scope of metallurgy is such that we must look upon this field as so important that it requires the full-time attention of specialists and not the casual attention of the mechanical or chemical engineer.

The architect is not really an engineer although he is a builder. Naturally, the fields of architecture and structural engineering flow into each other without a sharp line of demarcation. The main function of the architect, however, is to design the arrangement of building and its details, while the structural engineer designs the supporting structure, and then one or the other follows the building through the construction period to see that it fulfills all plans and specifications. The modern architect follows closely the ideal of "arrangement to serve the intended function" and is more likely to be in agreement with the engineer than were his classical predecessors.

Some architects have extended their planning function beyond the single building to include residential or business areas, towns, or whole regions; their work is called city planning or regional planning. The reconstruction of shattered European cities after World War II should bring before us the need for replanning America's metropolitan areas.

The naval architect is really a marine engineer. He designs and supervises the building of ships of war and ships of commerce or pleasure. Naval architects are trained only at a few colleges since the demand for their services is not great in peace-time.

There is a large number of engineering specialties for which courses of study are available in certain institutions. We have already mentioned sanitary engineering which is one phase of public health engineering. Biological engineering extends the scope of these studies to the food industries. Several engineering specialties are directed toward a single industry, of which the most important, aeronautical engineering, has already been mentioned. Others that are considered less critical today are railroad engineering, automotive engineering, gas engineering, and petroleum-production engineering. However, for most persons, the best opportunities are likely to exist in the broad field of civil, electrical, mechanical, or chemical engineering.

How to Become an Engineer

Of course, the most direct procedure for becoming an engineer is to spend four academic years of nine months each in an accredited engineering school, although it has always been possible for an industrious person to study during the summers and to complete the regular engineering curriculum in three years. Shorter courses train technicians who may become engineering assistants, but such short courses are not intended for the education of the professional engineer.

Many engineering schools operate co-operative courses of engineering study. The usual plan is for the student engineer to spend from two to four months in class alternating with similar work in industry. An engineering degree can usually be earned in five years of such a co-operative program. By using ten or eleven months of the year for study, it is possible for a fully employed person to complete the requirements for an engineering degree exclusively in evening school in about seven years. It is also possible to develop a background of science and engineering by home study and practical experience. This is the hard way.

The engineer deals with men, money, methods, and materials. He plans, constructs, operates, and produces. Wherever capital is invested or government works are constructed, you will find the engineer. Wherever he is, you may be sure that responsibility follows him. And because of his willingness to accept responsibility and his ability to produce under difficult conditions, the engineer soon finds himself in an administrative position. After twenty years of practice, more than one-half of all engineers have become administrators. It is literally true that in order to remain an engineer, the engineer must often refuse advancement in salary and position. Strange as it may seem, some do.

EDITOR'S NOTE—

The above digest of the book has been contributed by John F. White. Throughout he has used the original wording as employed by Dean Grinter in the work, but has adapted the points which seem most interesting to our readers. Reprints of this article are available upon request from the Engineer office and it is suggested that readers might like to make it available to persons contemplating an engineering career.

SERVICE STATION *on the road to Tokyo*

ARMORED fighting machines are modern war's mightiest land weapons, but their heavy armor does not make them invulnerable. Occasionally minor damage to critical parts can put them out of action, completely nullifying their great offensive power.

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Engraving

(Continued from page 26)

and will certainly continue to change the present relative position of chemical industry with respect to the employment angle of its activity.

As illustrative of these specialties of which I speak, I might mention The Dow Chemical Company's activities in the fields of plastics and magnesium. To understand how these fit into the scheme of things at Midland, it is of interest to consider the relationship of Michigan geology to the historic growth of the company.

So often we are asked, "Why did Dow settle in Midland, Michigan?" The answer is found in a study of the geological structure of that particular area which provides an almost inexhaustible supply of chemical raw materials.

In past geologic ages, there was formed a bowl-shaped basement structure under the central part of Michigan, which was submerged beneath the sea. Centuries later the opening to the sea was closed and there was left a great bowl full of sea water, which, in the course of time, evaporated and deposited pure salt around the edges of the bowl at places like St. Clair and Port Huron, leaving a mother liquor containing other salts at the center.

At the same time, a porous sandstone structure filled the interior of the bowl as clay and sand and other minerals were washed in from the sides. Thus the bowl was finally filled with various strata of brine-bearing rock, all covered over with an impervious cap of rock and clay. Here, then, is found a concentrated brine containing about 11.5 per cent common salt, 10 per cent calcium chloride, 3.5 per cent magnesium chloride, together with a fraction of a per cent of bromine—a great storehouse of basic chemicals.

In addition to this stock of chemicals, there are also oil and gas in other of the rock strata in this great natural bowl. And over the cap and roof is a bountiful layer of glacial drift and soil on which thick forests grow, providing lumber and some fuel, but, better still, cellulose, lignin, and wood sugars—organic chemicals of great worth. So Dow came to Midland to be beside the sea—the underground sea of chemicals—over which the lamp of science could be rubbed with such telling effect that in 50 short years a great industry has grown up and stretched itself to the borders of the visible oceans—to the east and south and the west.

Thus Nature's storehouse, coupled with the activities of many scientific minds and the productive skills of many trained workmen, is the basis for the secure knowledge of many other new additions to the present list of more than 500 commercial chemicals produced from brines, ocean water, oil, gas, wood and coal, and sulphur.

The brine at Midland is produced from wells similar to oil wells and pumped through pipe lines to the central plant. Here it is freed from bromine by treatment with chlorine and subsequent blowing with air and absorption in alkali. The bromine-free brine or liquor is then separated into its constituent salts — sodium chloride, calcium chloride, and magnesium chloride— by a series of evaporations and crystallizations. The calcium chloride is sold as such. The magnesium chloride is the basis for production of epsom salts, and magnesium metal and magnesium chloride are also sold. The sodium chloride is electrolyzed to produce chlorine and caustic soda, and these are the foundation stones for a complex structure of organic chemical production. Some of the chlorine is sold in the form of chlorine containing organic chemicals, some as hydrochloric acid, some is returned to the process as sodium chloride, and some is discarded as waste chlorides.

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of chemical processes in which direct products and by-products are utilized, there is the production and consumption of power and heat from coal, with a carefully maintained balance of requirements for each, so that maximum economy is obtained.

We will avoid the complexity of it all by confining our attention at this time to two of the newer developments, plastics and magnesium.

We have limited our activity in plastics to those which are derived from wood, oil and brine—our basic raw materials. For example, there is ethyl cellulose. This is made by interaction of caustic soda which is derived from salt, and cellulose which is made from wood, and ethyl chloride —from chlorine—and ethylene—derived from salt and oil.

Another is styron, or polystyrene, which is prepared by application of heat from liquid styrene. The plastic material, styron, is a hard glass-clear thermoplastic substance useful in many industries. The liquid styrene is a basic constituent of certain synthetic rubbers with which you are already familiar. It is made by combining ethylene which comes from salt oil, with benzene—from coal, to make an intermediate called ethyl benzene. This substance is converted by heating and distillation into the liquid styrene.

A third plastic, saran or polyvinylidene chloride, is wholly a child of oil and brine. Ethylene—from oil—is combined with chlorine—from salt—to form trichlorethane which is readily converted to vinylidene chloride. Vinylidene chloride is a water-white mobile liquid which can be converted by a polymerization process into an inert, insoluble, thermoplastic material which can be formed into a large number of commercial articles. These have special utility because of their exceptional resistance to solvents and chemical action.

All three of these materials are thermoplastic and can be injection or compression molded or extruded into various shapes. All are now being used for war purposes, but many peace-time developments are ready for the civilian market when the post-war period arrives.

In recent times, there have been one or two new plastics placed on the market each year. Some of these are harder than those previously offered, some are more weather resistant, some are tougher, some are stronger, some are more resistant to moisture, and so on and on until it seems safe to assume that within the next decade, plastics will have been perfected to the point where they will be every-

day items in many fields of manufacture.

And now let us look briefly at the history of magnesium. It is a metal which has great strategic value in this war and gives promise of having very wide use in future peacetime affairs.

It was thirty years ago that Dr. Herbert Dow, the founder of the Dow Chemical Company, said, "There must and will be a major use for metal as light as this," and from that day to the present, the Dow Chemical Company has carried on an unbroken and extensive program of research, development, and production, with the result that today there is sufficient magnesium available for every existing government requirement and at the lowest price in history—a price lower on a volume basis than that of *any* other non-ferrous metal.

But you will be interested, I am sure, in a somewhat more intimate discussion of the development of magnesium.

When World War I broke out in 1914, Germany was practically the sole producer of magnesium in the world. The war cut off imports into the United States, and, although the demand was limited, the failure of supply was seriously felt in certain phases of the war effort. As a result, several companies in the United States undertook to produce magnesium in a small way, and the aggregate production covered most of the domestic needs during that war.

Starting in 1916, the Dow Chemical company developed a suitable commercial process for making magnesium from its magnesium chloride supply; yet the production was small when the end of the war came. And after the war, the demand for magnesium metal practically ceased, with the result that all but two of the various domestic producers went out of business.

However, adhering to Dr. Dow's original thesis that, "There will be a major use for this light metal," and realizing the significance of the ample supply of raw material from the Michigan brine and also that the power consumption involved was a desirable balance wheel in the overall economy of the Midland operations, the company elected to proceed with a long range development, and continued to make metal in the face of the handicap of no market for the product.

It determined to create a market, and to that end undertook a systematic development of magnesium alloys suitable for structural purposes and of methods of fabricating the metal. At that time, this was a virgin field. All during the period of the 1920's, this work proceeded, and as a result, strong alloys were developed and methods of casting, working, heat treating, welding, and fabricating were worked out. Efforts were constantly made to find commercial outlets for the metal, but progress in this direction was extremely slow.

In the period of 1921 to 1927, a small commercial use as replacement pistons for automobile engines was developed, but this proved commercially unsuccessful and was abandoned. However, the experience gained in fabrication methods proved very valuable to future improvements in alloy quality and fabrication procedures.

During this whole period, production of magnesium metal on a limited scale was continuously maintained. Some small sales outlets were developed, but until 1927, the annual production never exceeded 200,000 pounds and the sales were much less than that, and the ledger was written in red ink.

Magnesium alloys were not yet accepted as a structural material by the metal using industries, and the outlook was not bright.

One substantial tonnage developed, however, in the production of com-

mercial aluminum alloys by the Aluminum Company of America, and in 1927 Alcoa contracted with Dow for its magnesium requirements.

This was the first sale of a substantial tonnage of magnesium that Dow had been able to make, and it gave Dow the opportunity for the first time to produce on a large enough scale to get costs down to a level which would make the metal interesting to the metal-using industries.

The German producer of magnesium was formerly Griesheim Elektron, which became a subsidiary of I. B. Farbenindustrie. It was established in the manufacture of magnesium many years prior to the beginning of magnesium manufacture in this country and had the advantage of this much longer experience.

In the early '20's it approached Dow with the suggestion that Dow should adopt the Elektron process in place of the Dow process, and thus gain the benefit of I. G. experience, in return, presumably, paying I. G. a royalty. Both the Dow process and the I. G. process were based upon electrolysis of magnesium chloride, but both processes had been developed independently and without any interchange of information whatever. The methods of making dry magnesium chloride were different. The electrolytic cells were quite different. Even the information to be gleaned from publications was meager and of little value. Dow was not receptive to the I. G. suggestions and did not enter into any agreement with this German concern, preferring to rely on its own ability for success.

The field has always been wide open to any prospective competitor, but there was no financial attraction for others until the advent of World War II suddenly produced a demand for an immediate hundred-fold increase in production. Even then, private capital hesitated to invest in an apparent "War Baby" industry. Dow was almost alone in its willingness to increase private capital investment to obtain greater production for war purposes. In fact, most of the huge increase in actual productive capacity has been financed by the government.

Prior to this war, Dow was left alone in the production of magnesium, to invest its capital for many years without return, and to carry on the struggle to establish a magnesium industry in this country and to gain recognition for this metal from an indifferent and skeptical public.

For twenty years and more, Dow struggled to create a market for magnesium in the United States. Dow was not aided in its efforts by any government agency and had everywhere to combat the inertia and even active opposition of established metal-using industries. While it is true that there was a certain interest displayed by the army and the navy with reference to possible use of magnesium in aircraft, yet this interest was accompanied by great reluctance to accept the metal and greater skepticism as to its suitability for these purposes. But all the time it was widely known that the German magnesium industry was actively supported and subsidized by the German government in its preparation for war, and the uses to which the metal was being put were well known the world over. Still there was no substantial interest here until the war was upon us. Then the demand arose over night for metal to use for the very purposes which had so long been ignored.

But the story begins years before this urgent requirement for large quantities of magnesium was realized by the country at large, for it was in 1934 that the Dow Chemical company successfully extracted bromine from ocean water. This was a momentous event, for it was the first time in history that the limitless ocean had ever been used as the raw material source for chemical manufacture, unless, perhaps, you wish to classify salt and fish as chemicals.

This experience formed the background for the vastly larger operation of quickly producing great quantities of magnesium metal from the sea. The ocean contains a number of valuable mineral substances, but when we look at the analysis figures as ordinarily reported by the chemist, we are impressed chiefly with the fact that the ocean is a very dilute solution of a number of common salts. However, when we begin to apply engineering methods and calculate the amounts contained in a single cubic mile of sea water, we are astounded at the result and inclined to check the decimal point again, but it is true that each cubic mile of the ocean contains nine billion pounds of recoverable magnesium.

And now when we think that the seven seas of the world comprise 71 per cent of all the earth's surface, we begin to realize that while the supplies of the ores of iron, copper, lead, aluminum, nickel, and zinc are distinctly limited, the base supply of magnesium is well-nigh limitless and is of easy access. In this connection, we received a questionnaire recently which called for a statement of raw material inventories. Opposite the item salt brine, we wrote "the ocean." In a few days we received a further communication asking us to be more specific and give the exact figure covering this item of inventory.

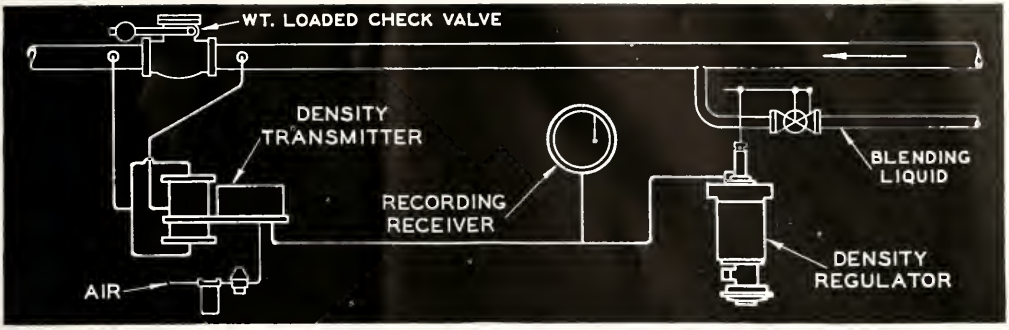
The construction of the magnesium metal plant at Freeport, Texas was begun in March 1940, and the plant began regular production ten months later—in January 1941. Just two months after that, in March 1941, came the order to double the output. In December 1941, this goal was reached and then again the word came that production must be greatly increased. This goal was also reached, and today there are adequate supplies and more of magnesium for all essential needs.

And, now, again, I want to remind you that magnesium, volume for volume, is the lowest priced non-ferrous metal in the world. When we further consider that this large-scale production from sea water is even now less than four years of age, it becomes a strain on the imagination to visualize all the future improvements and economies latent in this situation, which will measure the ultimate stature of this new-born child—magnesium.

But let us return to our subject, "Aladdin's Lamp," which was rubbed fifty years ago by a man with an idea —a man who wrestled with the idea without aid or interference from government bureaus or commissions—wrestled into a full-grown chemical plant. Herbert H. Dow could well be proud of the results of his labors. And since his death in 1930, his son, Dr. Willard H. Dow, and others have carried on until now there is a great system of chemical plants, at Midland and Marquette, in Michigan; at Pittsburg and Seal Beach, in California; at Freeport and Velasco, in Texas; at Wilmington, in North Carolina; in stations for chemical service to petroleum producers all over the country, and in similar stations for chemical service to industrial equipment in many manufacturing centers.

These plants are producing industrial chemicals, organic solvents, pharmaceutical products, aromatic substances, germicides, fungicides, insecticides, deodorants, fumigants, plastics, plasticizers, dyes, magnesium, flotation agents and wood products. These are literally hundreds of products, which are in daily use throughout the nation.

What are the prospects for chemistry in the post-war future? I think you can see that as long as there is opportunity for men of courage and good will to rub the Aladdin's Lamp of science and industry with ideas in an atmosphere of free competition, there will be new creations, new jobs, new wealth, new happiness, arising from the sea of life.



Typical installation for measurement and regulation of density.

REPUBLIC PNEUMATIC LIQUID DENSITY TRANSMITTERS

The Republic Pneumatic Density Transmitter employs the force-balance principle to establish an air pressure which varies proportionately to variations in density of a liquid flowing in a line. The air pressure is therefore a direct measure of the density and can be conducted to a remote location by means of small tubing. A receiver gage connected anywhere in this transmission line will show the variation in the density, and may be used as the impulse for actuating an automatic regulator.

The Transmitter can also be furnished for direct submersion in a tank or vessel, either open to atmosphere or under pressure.

OPERATING ADAPTABILITY

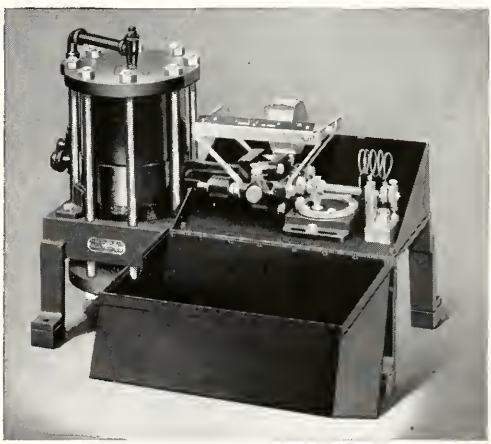
RANGE—Transmitters can be furnished for liquids of densities from 0.5 sp. gr. (compared to water at 60° F.), to the heaviest liquid known.

OPERATING RANGE—Can be as small as 0.05 sp. gr. and this may be from any base density. For example, range may be 0.6 to 0.65; 2.5 to 2.55; etc. Maximum spread may be any amount necessary; e. g.—0.6 to 3.0; 0.8 to 3.5; etc.

RANGE CHANGE—The base density may be changed approximately 3 to 1 by shifting the operating range adjustment weight. For example, the instrument may be built to show a change of 0.05 (or other range spread) above base densities from 0.6 to 1.8, the value of the base density being determined by the position of the adjustment weight.

The spread of the operating range can be changed approximately 3 to 1 by changing the position of the reaction diaphragm along the weighbeam. The base of the reaction diaphragm chamber is slotted to facilitate this change. The spread may be changed approximately 10 to 1 by changing the size of the reaction diaphragm. This change is easily made by changing the diaphragm plates, thereby changing the effective area of the diaphragm.

OPERATING PRESSURE—The standard transmitter is designed for operating pressures to 150 psig. Special designs are available for pressures up to 7500 psig.



The Republic Liquid Density Transmitter with cover open.

PERFORMANCE

ACCURACY—Output pressure vs. measured density is guaranteed accurate to ½ of 1% of range spread.

SENSITIVITY—Since the ratio of available force to effective friction is very large, and the motions required for complete operation are very small, the net dead spot in the mechanism is so small as to be undetectable by ordinary means, being less than 1/20 of 1% of minimum range spread of 0.05 sp. gr.

RESPONSIVENESS—At recommended sampling velocities, 90% of a change in density will register at the transmitter output in 15 seconds.

WRITE FOR BULLETIN NO. 44-10

REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois

The new pocket model of the Armour Magnetic Wire Recorder which has recently been developed at Illinois Tech's Armour Research Foundation.

FELLOWSHIP

(Continued from page 43)

Foundation. One of the first things he did there was to set up an electrical engineering division which works closely with the Institute's department.

Three other Westinghouse-trained men are key people in Illinois Tech's power systems engineering training. They are: Dr. William A. Lewis, who serves as research professor in the electrical engineering department and as consultant in this field to Armour Research Foundation, Fred J. Vogel, professor of electrical engineering and Lester LeVesconte, supervisor of studies on the network calculator.

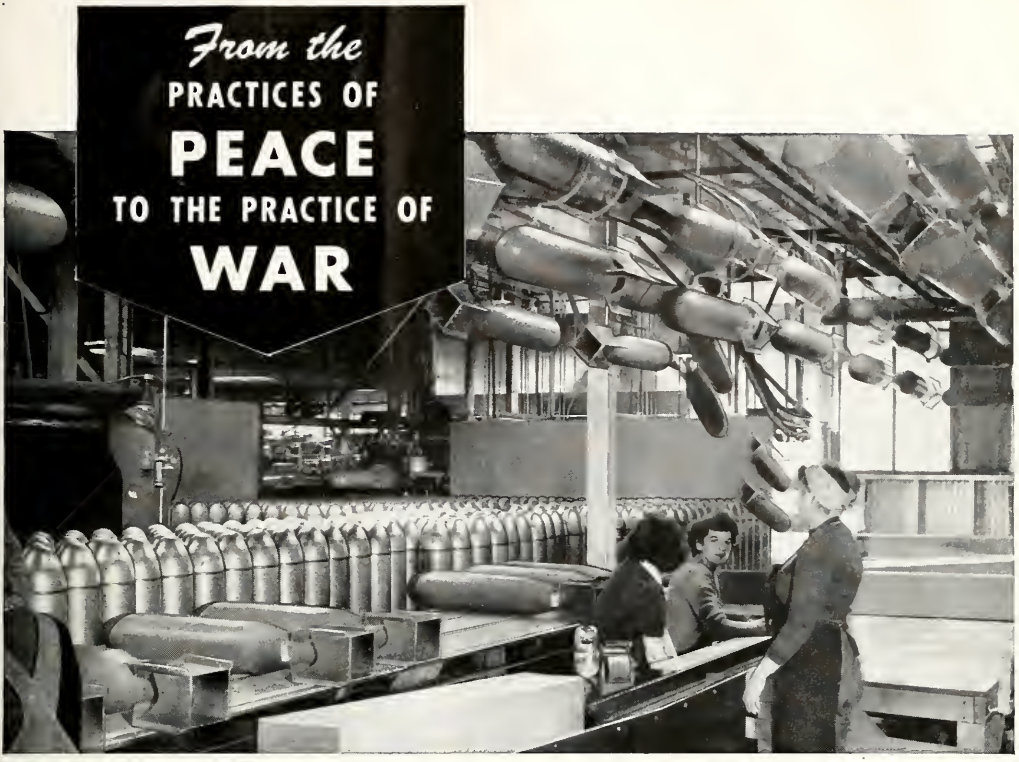
Dr. Lewis served for ten years as supervisor of power system engineering application work for Westinghouse in its New England and Pacific Coast districts. He has made notable contributions to power system relaying, the analyses of system stability, the derivation of transformer equivalent circuits, network calculator studies, and symmetrical components. Before joining Illinois Tech's staff in April, 1944, he was director of electrical engineering at Cornell University having held this position since 1939.

Mr. LeVesconte had a background of some eighteen years' service at Westinghouse, before joining the Illinois Tech staff late last year. He was in the switch-gear division at East Pittsburgh, where he spent some time as operator of its network calculator board; the relay division at Newark; and, since 1938, the central station division in Chicago. Since coming to the Chicago office he has assisted with network calculator studies for several companies.

The Westinghouse Educational Foundation hopes to renew this fellowship from year to year, in order that not one but a constant procession of capable young men may be given the benefit of training at Illinois Tech in this field.

SOME CHANGES

With this issue the *Engineer* drops class notes from its table of contents with these now being included in the *Technometer* alumni publication which goes to all graduates of Illinois Institute of Technology. The "Man of the Month" feature which has been run about alumni, however, is retained in this and future issues. One of the main factors influencing the change was that the *Technometer,* a monthly publication, will get news to alumni sooner than a quarterly.



Stove and Heater Plant Converted to Efficient Manufacturing of Practice Bombs by LAMSON CONVEYORS

When one of the great West Coast makers of stoves and heaters was awarded a contract for the production of 100 lb. practice bombs, it faced many problems. Materials handling was one of the most difficult. Moving raw materials to initial processes and semi-processed materials through operations was especially challenging, due to the irregular shapes of the component parts—and of the bomb itself. Second—no single building large enough for the complete job was available. Lamson engineers, employing a series of overhead and belt conveyors, linked two buildings into one smoothly operating unit, moving hard-to-handle materials to the job in either building.

Our engineers have selected 17 actual cases presenting difficult problems of conversion, analyzed them for you and presented solutions and results in an informative booklet entitled "Case Histories to Aid You in Blueprinting Conversion to Peace." Send coupon for your free copy.

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Send me a copy of "Case Histories to Aid You in Blueprinting Conversion to Peace."

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"C" Tools contain Common Quality Diamonds. Price $12.00 per carat. (Weight stamped on tools)
"M" Tools contain Medium Quality Diamonds. Price $24.00 per carat. (Weight stamped on tools)
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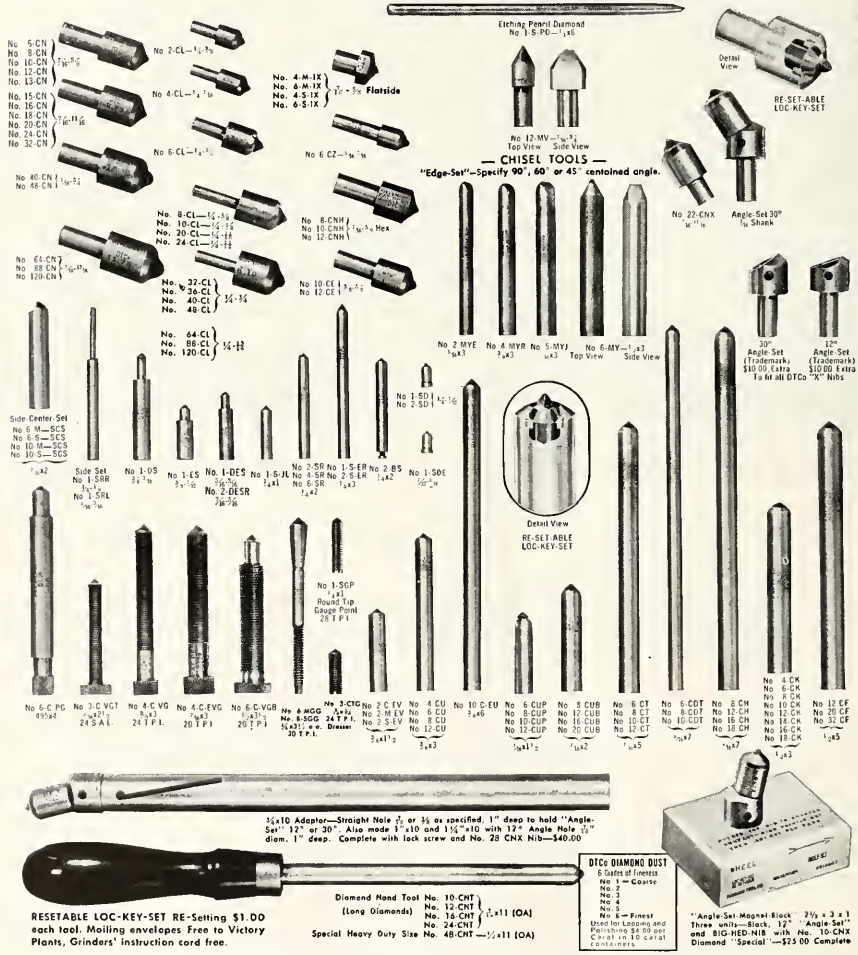
Tools listed below can be obtained in Medium or Select grades by substituting "M" or "S" instead of "C" in the tool number.

Any Nib Tool is obtainable with short shank (7/16" long) by adding "X" to letter designation

Minimum price of $5.00 is charged for small fractional carat tools. All prices are net.

All DTCo Tools are LOC-KEY-SET

RE-SET-ABLE means more for your money. Prolongs the life of diamond dressers.



INSTRUCTIONS FOR ORDERING: Number of each tool pictured is eight times the diamond size contained in tool, and is two times the diameter of grinding wheel each tool is suited for. Example—For 1/2 carat number of tool is 4, and it is suitable for 2-inch diameter wheel; for 3 carats number is 24, suitable for 12-inch diameter wheel. NOTE: Above recommended sizes are for heavy production and include an added 50% safety allowance. For light work add 1/2 diameter to recommended wheel size. Diamond weights are stamped on all tools where space permits. Farm Tool Diamonds: Special tools made from customers' prints and specifications. Reprints of this presentation furnished on request.

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Timken Tapered Roller Bearings can carry all kinds of loads — radial, thrust, or both together. The *amount* of these loads that the bearings can carry is equally important.

The load carrying capacity of Timken Bearings has been established on a thoroughly scientific basis. Each bearing's capacity has been checked and confirmed by extensive laboratory tests and by the field experience gained from the 500,000,000 Timken Bearings in service.

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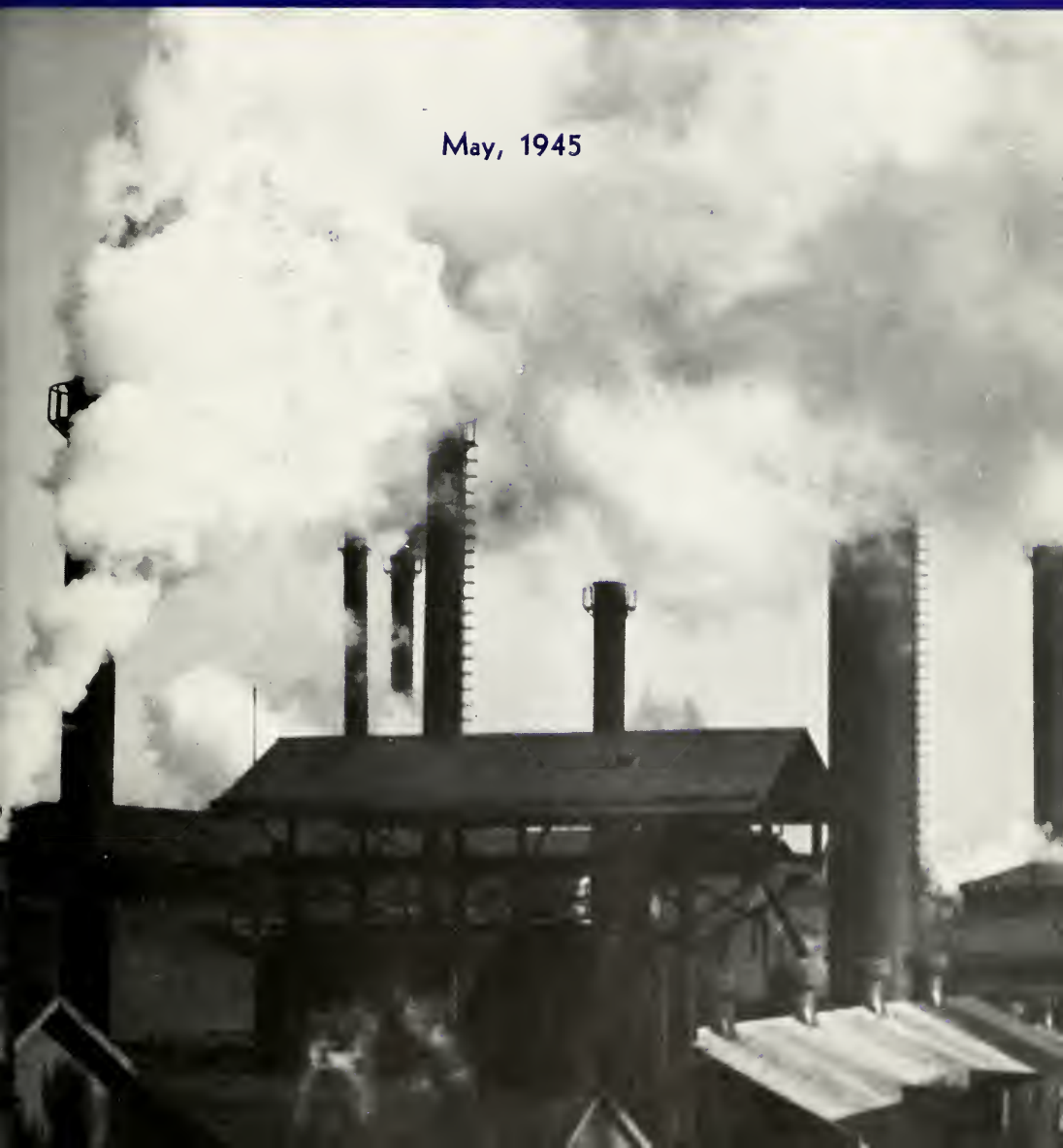
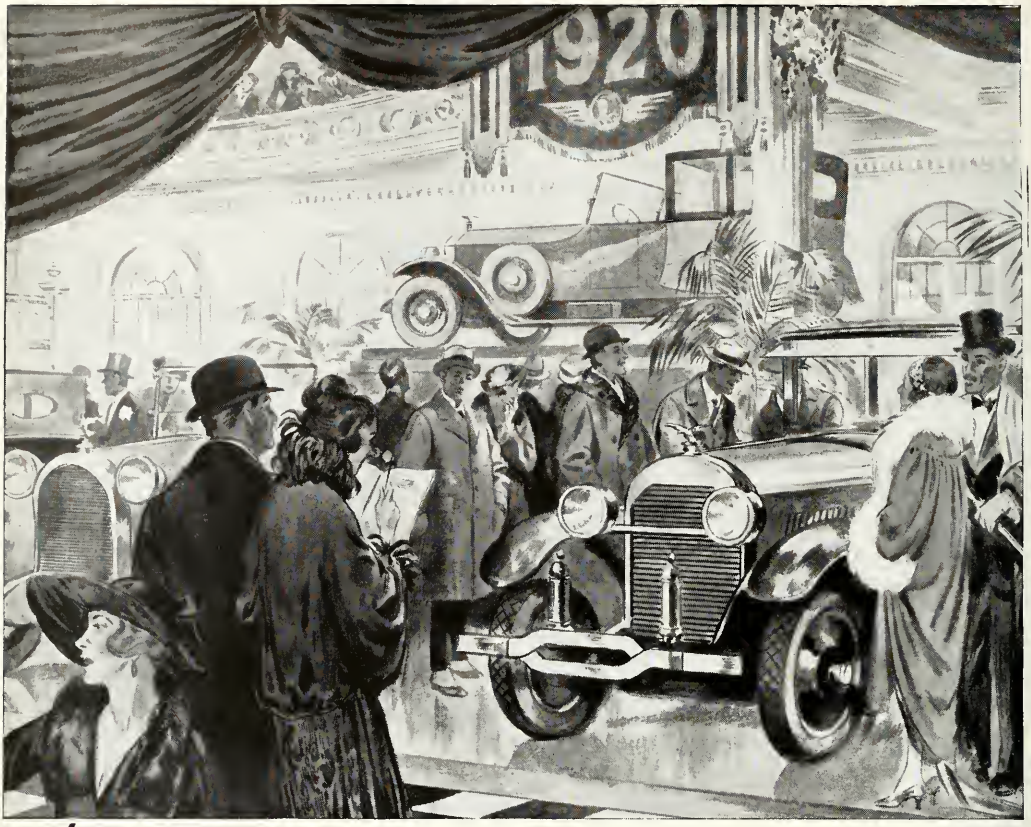
ILLINOIS TECH ENGINEER

AND ALUMNUS

May, 1945





No Longer a Luxury

On the day after New Year's in 1920, the National Automobile Chamber of Commerce opened its annual show in the "stately pillared arcades" of New York's Grand Central Palace. Keynote of the show was the announcement that the automobile industry was now producing "transportation." Here in a word was recognition that the automobile was "here to stay"... no longer a luxury but a necessary fundamental element in our national life!

Prophetic indeed was this announcement. For in the next two decades the automobile proceeded to alter, as never before, the entire pattern of American living. Out of the humdrum isolation of centuries came the farmer and the small town dweller. As hard surfaced roads networked the continent, America became the most mobile nation on earth, with the automobile firmly established as a cornerstone of our industrial economy.

Founded in 1920, Witco Chemical Company, Inc. has made important contributions to the growth of the automobile industry through the improvement of rubber tires. Among these are new and finer carbon blacks which have helped to increase the life span of tires from 5000 miles in 1920 to 35,000 miles in 1940. Other Witco products such as fillers, accelerators, dispersing agents and similar materials also aided in making the prewar natural rubber tire a triumph of durability and safety. And now Witco research is an increasingly important factor in helping the rubber industry match these qualities in synthetic rubber tires... not only for military cars but for large planes . . . giant bulldozers . . . trucks and many other types of mobile equipment. Born at the outset of the automotive industry's great past, Witco looks forward to serving its future needs with ever increasing efficiency.

WITCO CARBON BLACKS

A wide variety of carefully controlled quality blacks designed to meet the specific requirements of ink manufacturers for all the important types of inks.

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Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

HOSPITAL ON WHEELS

SOME PEOPLE—perhaps when they're very young—have a touch of tuberculosis. It may be just a spot on their lungs, which hardens and never causes any trouble. On the other hand, thirteen people out of a thousand, when examined by X ray, show evidence of reinfecrion tuberculosis. This does cause trouble unless it's treated at once.

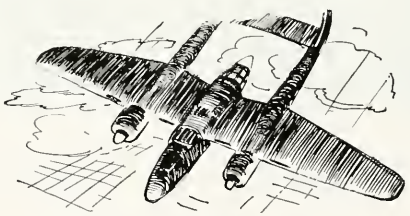
G-E photo-roentgen units make it possible for public health and welfare organizations to reach and examine, not only thousands of persons in large cities, but in rural areas and thinly settled sections as well.

Forty-five to sixty chest X rays an hour is the record of mobile units designed and built by rhe G-E X-Ray Corporation. As each person takes his turn in the bus-like vehicle, a small fast-lens camera transfers his chest image from the standard size fluorescent screen onto a supersensitive 4 x 5 inch X-ray film.

MAGNETIC MAP MARKERS

LOCATING an enemy position or tracing the course of our own convoy is a war job of the alnico magnet. Both Army and Navy use G-E sintered alnico as magnetic map markers—with its aid keep abreast of vital information.

Alnico is an alloy—of aluminum, nickel, cobalt, and iron—with greater magnetic power than any other known material. To make sintered magners G.E. begins by pressing powders of all these metals. After hearing and wet grinding, one surge of current makes alnico a permanent magnet. And with a piece of steel behind the wall map, the markers can move around but won't fall off.



DEATH FROM A P-61

SOMEWHERE in the European theater of operations there is a squadron group called the Green Bats, whose Northrop P-61 Black Widow planes carry as their insigne a green bat against a yellow moon.

These Widows fight by night—with G-E remote-control gunfire. Once they let loose, the four electrically-operated .50 calibre guns can swing a deadly barrage on their target. Each plane has two sighting stations. A gunner at either of them—or the pilot himself—can take a turn at building up the high score of enemy planes downed. In the two months following D-Day it totaled 400 for the Bats—and groups like them. *General Electric Company, Schenectady 5, N. Y.*

Hear the G-E radio programs: "The G-E All-girl Orchestra," 10:00 p.m. EWT, NBC—"The World Today" news, 6:45 p.m. EWT, CBS—"The G-E House Party," 4:00 p.m. EWT, CBS.

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ALL CLEOPATRA NEEDED WAS A PORTABLE SEWING MACHINE...

CLEO was a hep-cat! She gave from the hip . . . but solid. Remember the time she met Julius Caesar rolled up in a Persian rug . . . and little else? All Cleopatra needed was a portable sewing machine to be voted one of the "ten best dressed women of the Nile!"

All the nuts, bolts and screws—all the shuttles, cams and needles—yes, even all the aluminum in a portable sewing machine were on earth then, but Cleo's cleverest Afrits and Genii lacked the "know-how" to Imagineer them.

We coined "Imagineering"* to describe how Alcoa, and other great groups of technicians, go about the job of supplying the methods, materials and machines of modern life.

Today . . . youth laments that there are no new lands to discover, no new frontiers to cross. And yet, in the uncharted kingdom of the mind, hardy pioneers are daily spanning new horizons in the twin fields of invention and adaptation. Aluminum offers exciting new opportunities to every intrepid Imagineer . . . who seeks new industrial worlds to conquer.

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MAY 1945

ILLINOIS TECH ENGINEER AND ALUMNUS

VOLUME 10 NUMBER 4

IN THIS ISSUE

Published in October, December, March, and May. Subscription rat es, $1.50 per year. Editorial and Business Office, Armour College of Engineering of Illinois Institute of Technology, 3300 Federal Street, Chicago 16, Illinois.

CLARA BARTON — 1821-1912

CLARA BARTON "THE ANGEL OF THE BATTLE FIELD"

A complete narrative of the life of Clara Barton and the founding of the Red Cross in the United States involves one of the outstanding epics of humanitarian efforts in history.

The story of Clara Barton and her associates in the long struggle to realize their purpose should be read by all who are not familiar with it. It is the story of the most significant and wide-spread philanthropic movement of the age, "a movement that has become an intrinsic part of world civilization,"—"the embodiment of one vital principle of all religion"—"love for humanity."

Read the life of Clara Barton, you will gain an understanding of the "human-animal" in contrast to the fine spiritual content of her life. A great spiritual beauty exhales from the pages of her life's story—After all is said, she did write one of the mightiest chapters in the history of civilization.

Croname Incorporated Chicago

Contributors

Walter J. Armstrong is a chemical engineer on the staff of the Armour Research Foundation of Illinois Institute of Technology.

S. I. Hayakawa is associate professor of English at Illinois Institute of Technology.

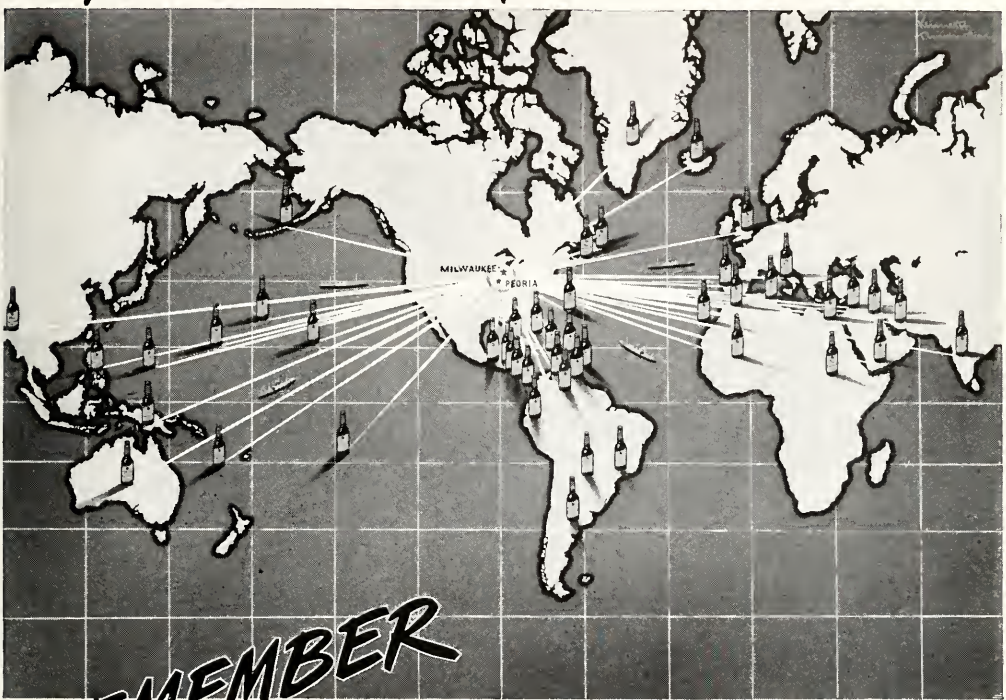
Paul D. Hermann is sports editor of the News Bureau at Illinois Institute of Technology.

Lester B. LeVesconte is supervisor of studies and chief engineer for the A-C Network Calculator recently installed at the Armour Research Foundation of Illinois Institute of Technology.

John P. Sanger is vice-president of the United States Gypsum Company, a member of the Institute's board of trustees, and an alumnus of Illinois Institute of Technology.

Cover—This photograph was taken at the Pencoyd Iron Works by W. M. Rittase, Philadelphia, Pa.

If you can't always find PABST—



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THE A-C NETWORK CALCULATOR

By

LESTER B. LeVESCONTE

The A-C Network Calculator does not calculate in the mathematical sense, but rather replaces extensive and impracticable calculations by direct measurement of voltages, currents, etc. in an actual miniature electrical replica of the system to be studied. This can best be understood by a short review of the events and practices that preceded and led to its development.

The first power systems were simple and consisted of a generator and a few lines direct to the loads. Fuses could be used for equipment protection in the case of short circuits, as they are used today in most residences. As systems grew larger and more complicated fuses became inadequate and various automatic circuit interrupting devices were developed, mostly known under the general term of circuit breakers. The proper application of these devices required a knowledge of the magnitude of the current to be expected at the time that they must perform their maximum duty, in other words, during short circuits. Methods were developed for calculating these short circuit currents and the proportion of the current supplied over each line or circuit on the system. The calculations were simplified by neglecting the resistances of the circuits and considering that the current was limited mainly by the reactance of the generators, transformers, lines, etc. The current naturally divided in inverse proportion to the reactance. Considering this, it was not difficult to design an assembly of adjustable resistors which could be connected in any combination, with some means of measuring the current in each resistor. These resistors could then be connected in the same manner as the reactances of the system to be studied and adjusted to have values equivalent to these reactances. With the positive terminal of a direct current source connected to all the resistors representing generators, the negative terminal could be connected to any point on the network at which it was desired to know the short circuit current. The resultant currents in the resistors would be proportional to the total short circuit current as well as the current in every circuit and, with proper multipliers, would indicate the system current in amperes. Probably because this took the place of considerable calculations, this device was called a d-c calculating board.

Power systems continued to grow, and with the growth came additional and more complex problems such as load division and voltage regulation in involved networks and stability between large inter-connected generating stations. The proper representation of these conditions in a miniature setup required a representation of the phase angle of the impedance, power source, etc. This demand was finally met about 1929 when some devices were developed using alternating current for power instead of direct current and arranged to represent reactances, resistances, and capacitances as well as the phase angle between the power sources. It was natural that they should be called A-C calculating boards. The further perfected and modern version of this equipment is now known as the A-C Network Calculator or analyzer.

While a calculator is recognized as an invaluable aid in answering questions on power system design and operation, the cost involved in the installation and operation of the device is more than most companies can justify for their own use, particularly since continuous use is not required. Usually the time required to assemble system data for the study and to interpret the results of the study is much more than the time actually spent on the calculator. For this reason, most companies have depended on leasing time on the few calculators that were available and they have made studies only when the problem could not be answered satisfactorily in any other way. Considering that the time available on the calculators that can be leased is becoming more and more in demand, it is natural that a group of companies should cooperate in a project to install one of their own, thus obtaining many of the benefits of ownership at a small fraction of the total cost.

The Illinois Institute of Technology was selected as a good place for the installation of a calculator on a cooperative basis, not only because of its central location and the availability of the district headquarters of most manufacturers, but also because of the experienced, technical staff available for consultation. The project was financed by dividing the total cost into fifty units, which were purchased by the participating companies, each unit entitling the company to use the calculator for one week each year for twelve years. Forty-eight of the fifty units have been purchased by the following seventeen companies:

Allis-Chalmers Mfg. Co.
Carnegie-Illinois Steel Corp.
Inland Steel Co.
Interstate Power Co.
Iowa Electric Light & Power Co.

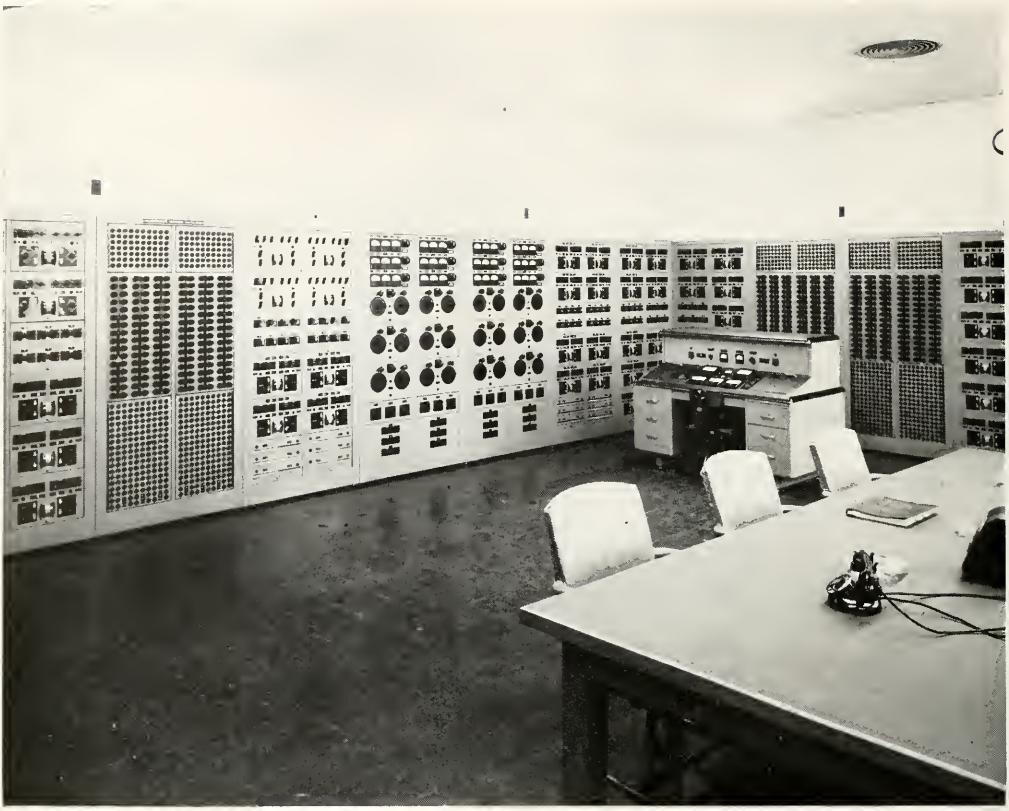

Figure 1. General View of Calculator Installation

Iowa-Illinois Gas & Electric Co.
Kansas Gas & Electric Co.
Ohio Public Service Co.
Otter Tail Power Co.
Sargent & Lundy
United Light & Power Service Co.
Westinghouse Electric Corp.
Wisconsin Electric Power Co.
Wisconsin Gas & Electric Co.
Wisconsin-Michigan Power Co.
Wisconsin Power and Light Co.
Wisconsin Public Service Corp.

The calculator was purchased from the Westinghouse Electric Corporation and includes all of the latest features. While a first impression may be that it is a very complicated piece of equipment, a short study will show that it is built up on a relatively few kinds of basic units, each of which in itself is easy to understand. Figure 2 shows the various units associated with the equipment they are used to represent. By using the method of symmetrical components, three phase systems are represented on a single phase basis, each section of a three-phase transmission line or circuit being represented by a single resistor-reactor circuit on the calculator. In order to reduce the physical size of the reactors and condensers, the calculator is designed to use a frequency of 440 cycles, which does not complicate any setup since all units are calibrated in ohms.

The most general type of circuit contains a resistor adjustable from 0 to 399 ohms in series with a reactor adjustable from 0 to 300 ohms. There are 100 of these line circuits and they are used to represent impedances of transmission lines, series impedance of transformers, and all general series impedances of the system.

Loads are also represented by impedances, but since they are connected in shunt, the impedance values are much higher than the series impedances used for the lines. For this purpose there are 40 load circuits with a resistance range of 0 to 3990 ohms and a reactance range of 0 to 2400 ohms. For convenience in calculating and setting these circuits, the resistance and reactance can be connected either in series or in parallel. There is one difference between the operation of the load circuits on the calculator and the actual loads on the power systems. The load taken by one of these circuits will vary as the square of the voltage, while the load on the actual system is not so much affected by the system voltage. To correct for this difference, each load circuit includes a tapped autotransformer, called a load adjustor, by which the load can be maintained easily at the desired value.

The capacity of long, high-voltage transmission lines cannot be neglected, and this is represented on the calculator in the form of the equivalent pi circuit, that is, half of the total capacitance is represented at each end of the line. Since several lines usually are connected to a common point, all of the capacitance to be represented at that station is combined into a single capacitor connected to the bus. Thirty-six adjustable capacitor cir-

cuits are available for this purpose, or for use wherever a capacitor circuit must be represented.

Most transformers can be represented by the series impedance reduced to a common voltage or kva base. Whenever the transformers are a part of the closed loop on the system, the exact ratio of all transformers around the loop may not be the same as the voltage ratings picked for determining the base. To make up this difference there are 18 variable ratio autotransformer circuits adjustable in .5% steps over a range of ± 10%.

In most cases where it is necessary to represent mutual impedances between transmission lines, this can be done by a special connection of the line circuits. For those cases in which this simple connection is not possible, there are 18 low-leakage, mutual transformers available. Also, there are a number of metered and unmetered jumper circuits for use where a connection without impedance is needed.

Instead of using a single source of power, as is done on the D-C calculating board, the A-C Network Calculator requires a separate unit for each power station to be represented. These units are actually phase shifters, energized from a common three-phase source, and arranged to provide a single phase output adjustable for any phase angle and any voltage magnitude from 0 to 400 volts. There are 12 such power sources, each one equipped with a special low-resistance reactor circuit to represent the internal reactance of the generating station. For each one there is also a set of instruments to give an approximate indication of the voltage, current, and power of the circuit.

In order to represent all types of networks or power systems, means must be provided to connect the above circuits in any desired combination. On this calculator three plug boards are provided for this purpose, each having 96 pairs of plugs and 25 rows of receptacles. Each pair of plugs is the terminal of one of the above circuits, the number of which is marked on the panel between the plugs and also on the back end of each plug for easy identification. The receptacles are connected so that all plugs in adjacent receptacles are connected together. Therefore, to connect any two terminals together it is only necessary to insert them in the adjacent receptacles anywhere on the panel. Sometimes it is necessary to make a connection between a plug on one board and a plug on another board. For this purpose the receptacle at the right-hand end of each row on each board is connected to the corresponding receptacle on each of the other boards. Likewise the left-hand ends are also connected. In this way a plug in one of these end receptacles on one board is actually connected to the corresponding end receptacle on each of the other plug boards. In the row immediately below the plugs the receptacles are all connected together and form a system neutral from which all voltage sources originate and to which all shunt loads, shunt capacitors, and faults are connected.

Separate from the cabinets along the wall (but connected electrically through a trench) is the main metering desk at which all accurate measurements are read. A metering bus of #7 wire is run from the metering desk and extends over the entire assembly of cabinets. In the cabinets

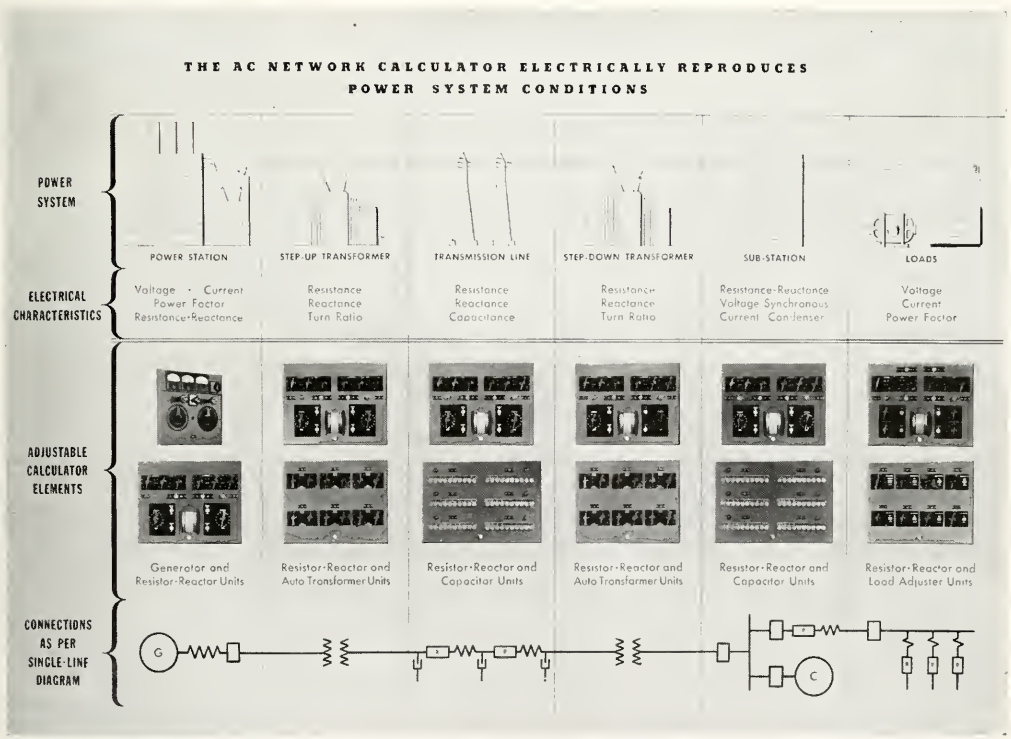

Figure 2. Chart Showing Relation between Actual Power System and Elements of Network Calculator

Figure 3. Meter Desk at Which All Accurate Measurements Are Made

each circuit is provided with a small relay arranged to connect that circuit to the metering bus. These relays are energized selectively by a circuit selector on the metering desk, controlled by a set of buttons conveniently located near the right-hand end of the meter desk panel. Thus, by the manipulation of a few buttons on the meter desk, the operator can connect his accurate instruments to any circuit of the calculator.

On the meter desk there are two independent sets of instruments. Along the lower edge of the meter panel is a set of three instruments for reading scaler values of amperes, volts, and watts or vars. These are standard torque instruments, but they are operated through thermionic negative-feed back amplifiers so that the actual burden on the network is very small. Convenient switches permit selecting the most suitable scales. The volt meter can be connected for full scale readings of 125 or 250 volts, while the ammeter has five ranges with full scale readings of 6, 2, 0.6, 0.2, and 0.06 amps. The watt-var meter is

(Continued on page 30)

Figure 4. Reception and Conference Rooms Adjoining Calculator Room

35TH AND STATE:
REFLECTIONS ON THE HISTORY OF JAZZ

By
S. I. HAYAKAWA

The following article was a Poetry Magazine Modern Arts Series lecture, given Saturday, March 17, 1945, at the Arts Club of Chicago. The author is profoundly indebted to the musicians and artists who illustrated with their performances the various points of the lecture: Mr. and Mrs. James Yancey, Miss Elizabeth Jeffries, Oro "Tut" Soper, Richard M. Jones, Darnell Howard, and Thomas Taylor.

New Orleans Tradition

Like other American cultural forms, indeed, like the American people themselves, jazz is hybrid. As everybody knows by now, especially through such energetic efforts as those of *Esquire Magazine* and the author of *Jazz Record Book* and *Jazzmen*, jazz originated in and around New Orleans. Its ultimate source is Negro folk-music, work-songs that lightened their labor, dances and shouts that expressed relief from labor, religious songs and chants that expressed their devotion, the dance rhythms brought over from Africa that were preserved in such institutions as the slave-holidays in Congo Square, and the field songs which, unknown to white overseers who interpreted them as indications of contentment, often conveyed from one group of field-hands to another secret messages aiding the escape of fugitive slaves and slaves in trouble. Even in these early stages, this folk-music was not purely Negro, since elements of Scottish, Irish, and English balladry and strains from Baptist and Methodist hymnals had been incorporated into the music.

It was in New Orleans that a great transformation overtook this folk-music. Enjoying more opportunities and more freedom there than in most other Southern cities, the Negroes got, in a somewhat backhanded way, the impact of the French musical culture of that city. As servants, they heard at social occasions the predominantly French dance tunes: polkas, mazurkas, quadrilles. In the streets they heard marches played by brass bands. Many Negroes acquired, by purchase or as hand-me-downs, second-hand musical instruments, such as cornets, trombones, and clarinets. Having at first little or no opportunity for formal musical training, they experimented with the instruments without instructions, and began to form bands of their own. The increasing Negro social life of the city created a demand for more Negro musicians. Gradually, there evolved in the late nineteenth and early years of the twentieth century, an entire new style of band playing, originated on the whole by Negro musicians who had never had formal musical training.

Dr. S. I. Hayakawa

There are four outstanding points to be noted about this development. First is the fact that the folk-music background of these Negroes caused them to try to reproduce, in their harmonies and in their generous use of slurred and wailing notes, as well as in their marked rhythms, the styles of singing and group improvisation that characterized their earlier vocal efforts, such as spirituals, blues, and work-songs.

Secondly, having had few music lessons, these early instrumentalists were never instructed in what NOT to do. They tried all sorts of effects that teachers would have told them were "improper" or "sour" or even "beyond the range of the instrument." In other words, they took an entirely fresh view of these instruments and their possibilities. Not knowing that certain kinds of noises that came out of their instruments were regarded by teachers as "incorrect," they took delight in making them and finding places where they sounded right. Not knowing that it was supposed to be impossible to reach certain high notes on a cornet, they reached for them and got them. Not knowing that a trombone was supposed to be an accompanying instrument, they played solos with it. They broke all the rules, and therefore they made tremendous discoveries.

I am told that a delegation of the brass section of the London Philharmonic Orchestra waited on Louis Armstrong when he was appearing in London, and demanded that he show them how he got his effects (which they had heard on records) "without the aid of some mechanical contrivance." Armstrong promptly played a *glissando* for them, from the lowest

possible tone to a note a fifth higher than they had ever heard before on a cornet, *and down again,* without a single pause or break in its magnificent fluid continuity.

Third, they restored to music something that Western music had all but lost a couple of hundred years ago as the result of the division of labor between composer and performer. In ordinary musical situations the performer, following a score, tries to interpret accurately the composer's intention. These early jazz musicians, however, had no score to follow and in many cases would not have been able to read it if they had. Partly because of the simplicity of the folk-themes they played, partly because the musicians sometimes didn't know what they were supposed to do and had to make something up for themselves as they went along, and partly out of sheer musical exuberance as they achieved greater mastery of their instruments, all jazz musicians improvised, both in solo and in group work. The skill and ingenuity of improvisation became more and more impressive as time went on. It was not long before every good band was a crew of skilled improvisers, each player influencing and being influenced by his fellows. Every performance of an old theme therefore became a new creation. In other words, the performer and composer were rolled back into one, restoring to music a spontaneity and zest which the white world had almost forgotten could exist.

Fourth, and this is perhaps the most important point: the work of these New Orleans musicians represents the first and perhaps only time in which a folk-music was enabled to continue to develop as folk-music, *but* with the technological advantages of modern instruments and their orchestral possibilities. If the Negroes had been left in the fields, their folk-music would have continued like other folk-music, Scottish, African, Western American, etc., primitive and charming, with no more technical resources than could be offered by bagpipes, tomtoms, crude string instruments, and the like. If, on the other hand, the Negroes had been fully assimilated into New Orleans life, they would have forgotten in a generation or two their folk backgrounds, and they would have been culturally assimilated into the white world, and their children's children would have struggled note by note over the compositions of Ethelbert Nevin.

What happened, of course, was neither of these things. In one way they shared the New Orleans culture, but in another way they didn't. They were both within the white culture and outside it. However unjust or unfortunate this situation may have been (and it continues so to this day), it meant that Negroes were forced back onto their older folk culture and pushed forward into a new culture at one and the same time. They therefore did the only possible thing: they fused the two strains of influence. In so doing, they unwittingly gave to American culture as a whole one of the greatest gifts any minority has brought: a new musical synthesis of urban sophistication with folk feeling.

White musicians in New Orleans caught the idea at once, and added some tricks of their own. The Negroes learned these tricks at once and added newer ones. From 1900 to 1917 there was continued interaction between Negro and white musicians, each learning from the other, so that by the time jazz began to spread all over America, it was, in spite of basic Negro contributions, a joint product of all the cultural strains that centered on New Orleans.

But why, once jazz began to spread, did it spread so rapidly and so widely? I believe the answer lies in the elements that went into it. Jazz is most popular in the big cities, in Europe and Asia no less than in America. City people, I believe, consciously or unconsciously miss the directness that characterizes folk experience. In our highly technologized urban cultures, we miss that directness most of all. Yet we cannot regress to more unsophisticated modes of feeling. Jazz, therefore, meets a profound need in our civilization because it is a unique fusion of a high degree of technical resourcefulness and inventiveness with the undiluted, elemental down-to-earthness of folk-expression. When that fusion isn't there, so far as I am concerned, it isn't jazz.

(EXAMPLE: "High Society," played by the Richard M. Jones Trio: Darnell Howard, clarinet; Thomas Taylor, drums; Richard M. Jones, piano.)

Rent Party Blues

In 1917, the entire district in New Orleans in which jazz had flourished was closed down by federal authorities for reasons which had best be left unmentioned before so chaste an audience. From that time on, the history of jazz centers around Chicago. In this mass migration of musicians, here came "Jelly Roll" Morton, the greatest of jazz pianists; here too came King Oliver and Louis Armstrong and Jimmy Noone and Johnny Dodds and Baby Dodds and Sidney Bechet and Wellman Braud and Barney Bigard and Zutty Singleton. The greatest of the early white bands, the New Orleans Rhythm Kings and the Original Dixieland Jazz Band, also migrated here, as well as musicians from Washington, Kansas City, Cincinnati, and St. Louis. By 1925 Chicago was the jazz center of the world, and its hub was at 35th and State streets. Sitting at the feet of these musicians getting their education were Chicago-born kids: Muggsy Spanier, Gene Krupa, Benny Goodman, and that group of jazz-intoxicated youths from Austin High school who were later to make that institution famous. But all this, and the influence of highly educated Negro and white musicians on the development of jazz, is the subject of two or three other lectures. Parallel to the orchestral development, yet in part independent of it, was the development of the vocal blues, usually with piano accompaniment. In Chicago's South Side there used to be a social institution known as the rent-party.

The rent-party had its start, according to the authorities I have consulted, long before Prohibition. Originally it was a party given by a family to raise funds as rent-day drew near. In some cases a small admission price was charged. Later it became customary to let people in free, and to rely on the sales of food and liquor as the source of revenue.

A little reflection will show how necessary these rent-parties were. High rents in the Negro community are not a war-time phenomenon. Housing for Negroes has been scarce, because of the confining of Negroes to rigidly confined areas, for decades before the present war. Negroes in Chicago have therefore long been compelled to pay a disproportionate share of their income for housing.

The rent-party, then, constitutes what students of the cooperative movement might well regard as a primitive cooperative housing plan: you come to my party and help pay my rent, and after payday I'll come to your party and help pay your rent. However, by the time the institution reached its highest development during Prohibition days, it seems to have become less a form of neighborly cooperation and more a form of individual business enterprise: that is, rent-parties were given regularly by some households as a source of family income.

The importance of the rent-party in American culture rests upon the fact that the principal means of entertainment was piano music and the blues. Hundreds of impecunious young

Jazz thrived at "rent parties" on Chicago's south side. Earl "Father" Hines and his rhythm section typify the entertainment that flourished at the fund raising sessions that became a social institution.

men, eager to pick up a few dollars and an evening's entertainment, vied with each other at these parties in piano virtuosity. More often than not, there would be two or three piano players at the same party. And, more often than not, they would get into competition with each other, the best players being assured of more drinks, more food, and more invitations to further parties than the others. The competition was terrific.

It was a tough, realistic school of piano. There were no lessons, except what you could pick up from watching others. Those who couldn't maintain the pace would soon find themselves having to pay for their own gin. It is no wonder, then, that so many brilliant pianists are to be found among the older generation on our South Side, many of whom have never appeared with an orchestra or on the stage.

The basis of the South Side piano style was, of course, the blues, which later developed into that peculiar percussive style known as boogie woogie. William Russell, writing in "Jazzmen" (edited by Ramsay and Smith, Harcourt, Brace; 1939), describes it as having "immense vitality"; but he is even more enthusiastic about its technical aspects:

"In making full use of the resources of the instrument," he says, "the Boogie Woogie is the most pianistic of all styles. . . Jimmy Yancey developed a style so pianistic that it could not be imagined on any other instrument; yet it shows not the slightest resemblance to the piano music of the nineteenth century Europeans. In creating his style Yancey had, apparently, never listened to conventional piano classics. He tried to get out of a piano just what was in it, and not to give an imitation of an orchestra, a trumpet, a voice, or a hurdy-gurdy. He succeeded most admirably. The piano is,-after all, a percussion instrument and one capable of producing more than one rhythm at a time, although it takes considerable ingenuity to do this. . .

"The melody may be widely separated from the bass and progress in contrary motion. Throughout there is an ignorance of conventional harmony which amounts to a most refreshing disrespect for all rules. This is a music constructed out of the piano keyboard rather than a harmony book."

As Jimmy Yancey himself will tell you, he is not alone in his accomplishments. Behind him and behind all the others is a long tradition of blues piano-playing. E. Simms Campbell tells us in his essay on the blues that "Boogie Woogie piano playing originated in the lumber and turpentine camps of Texas and in the sporting houses of that state. . . In Houston, Dallas, and Galveston—all Negro piano players played that way. This style was often referred to as a 'fast western' or 'fast blues' as differenti-

ated from the 'slow blues' of New Orleans and St. Louis."

Richard M. Jones has also told me something of that Southern piano tradition. Throughout the South there were migrant pianists, moving around from one little disreputable "tonk" to another, displacing other pianists of whom the customers had tired, and being displaced in turn a few days or weeks later by a new pianist. They all played blues, each in a style characteristic of his region, so that one could listen to a man play a few bars and say to him, "Say, you're from Arkansas, aren't you?" and you'd be right.

Ferdinand "Jelly Roll" Morton, he of the proud heart and fiercely competitive spirit, was never content to stay long in a comfortable job in New Orleans. He had to take to the road every now and then to pit himself against all the itinerant pianists, partly to experience the joy of whipping them, partly to learn more tricks from them. He would return from these jaunts ragged and broke, but he would always cry exultantly when he returned, "Say, I whipped every piano player between here and Mobile!"

(Once "Jelly Roll" returned to New Orleans and told his friends that he had been in Chicago, where his piano playing had stopped the street-cars. His friends, Mr. Jones tells me, long accustomed to Morton's bragging, winked at each other. But a few days later, they got the *Chicago Defender*, and read the story with their own eyes. The crowds in the 3100 block of State street, where "Jelly Roll" had been playing, had actually blocked the traffic.)

Such, then, are the backgrounds. As one Southern piano player after another came to Chicago, many of them in box-cars, they made for State street; they played the blues; and if they were good, they got asked to rent-parties.

The story of boogie woogie and the blues, then, is the story of a folk-art come to maturity. It is still with us, still very much alive, and still pouring out ideas which, thanks to the phonograph, are being studied by serious musicians in the four corners of the world.

(EXAMPLE: "How Long, How Long Blues," sung by "Ma" Yancey, accompanied by Jimmy Yancey. Mr. Yancey's left hand was affected by a recent illness and he has not yet fully recovered its use. He has therefore asked to be excused from giving an example of solo blues.)

Blues Become Abstract

Every art, as it approaches maturity, tends to become abstract. An excellent painter, for example, is only incidentally interested in the "likenesses" he produces; he is much more interested in the interplay of colors, of light and shade, of masses and lines, than he is in the trees or cows or people which he starts out with. The modernist painter becomes so interested in these abstract qualities that he skips altogether the trees and cows and people, concentrating his efforts entirely on producing new visual relationships.

In the musical form we know as the blues, a similar evolution takes place. At first it expresses ordinary human feelings: homesickness, disgust, loneliness, sometimes a kind of bitter joy: "All the people I see, why do they pick on poor me, and put rocks in my bed, rocks in my bed." "You've been a good old wagon, Daddy, but you done broke down." "Michigan water taste like sherry wine; Mississippi water taste like turpentine."

Although the piano, like the guitar, starts out as the accompaniment to a vocal blues performance, an instrument with its technical resources has an irresistible fascination to anyone who has music way down inside him. The accompaniments gradually became more important than the voice. One can do such odd and interesting things with a piano! Listening to the early piano records such as those by Pinetop Smith and Cow Cow Davenport, you can see the development taking place. The sentiments expressed become secondary and incidental. The performer is increasingly concerned with purely rhythmic and musical relationships.

Boogie is the result. It is the blues gone abstract. In every art, there is an emotion beyond emotion. This emotion of higher order may be termed a technical passion, although this is perhaps too cold a term. It is to be seen when an artist becomes so complete a master of a form that he can begin to play tricks with it. "Look, look," the artist seems to say. "Look at the things I can do with this form."

The architects and craftsmen of European Baroque went to town with pillars. Look at all the things that can be done with pillars, they seemed to say as they involuted them, convoluted them, knurled them, gnarled them, spiraled them, thinking up one stunt after another. So too the Chinese craftsmen who carved snuff-bottles such as you see now at the Art Institute; they carved them outside with figures or flowers or landscapes; they carved them inside so that the designs would show though the translucent stone; they carved them with stories and they carved them with abstract designs. "Look, look," they seem to say, "look at all the things we can do with snuff-bottles!"

Similarly, if you study the recordings of boogie woogie, you will find the same technical passion, brought to bear, in this case, on the blues form. Look, look, the performer seems to say. Look at all the things you can do with piano blues. You can make 'em ring out like chimes; you can make 'em cascade like falling icicles; you can make 'em sound like a train going over a bridge; you can make 'em stutter comically like someone overcome with embarrassment; you can make 'em assertive and rude; you can make 'em whimper like a lost dog; you can make 'em rumble like an upset stomach; you can make 'em stomp and holler and shout. Look, look!

That, I believe, is the secret of boogie woogie. In the blues, rent-party pianist found a form that is apparently inexhaustible. True, you always have to stick to a twelve-bar stanza. But look what you can do by fluttering this chord while the left hand maintains its beat! Look at the nice chorus you can make with only three little notes repeated over and over! Look at what happens when your right hand gets one beat ahead of the left! Listen to the odd way you can intermesh a three-beat in one hand with a jumped-up four-beat in the other!

All the best boogie pianists have this abstract quality, this technical passion. It is to be observed to a marked degree in Albert Ammons and Pete Johnson and Meade Lux Lewis and Maurice Rocco. Its earliest clear manifestation is to be found in Jimmy Yancey. But since Jimmy Yancey is not able to demonstrate this to you as he would like to, and as he will again be able to do after a few more weeks of convalescence, Mr. Richard M. Jones will demonstrate a few of the Boogie Woogie styles.

(EXAMPLE: Texas fast blues; New Orleans style blues; Chicago style boogie woogie; Kansas City rag. Richard M. Jones, pianist.)

Jazz Goes Serious

Every art, in order to maintain its vitality, must periodically refresh itself, strengthen itself, in folk experience. The romantic movement in English poetry was, in a large degree, poetry coming to life again after the artificiality and pompousness of the age of Johnson by being revivified by the discovery of English and Scottish balladry. Coleridge's *Rime of the*

Ancient Mariner is not, to be sure, an unsophisticated folk-ballad; but it could not have come into being if Coleridge had not found in the ballad form a new source of strength. The entire modern movement in painting provides another example of art returning to more primitive modes of feeling for renewed power; it began, significantly, with a movement that called itself Pre-Raphaelite and went to Italian primitives for inspiration. In our time modern art has continued

Pete Johnson's nimble fingers supply half the boogie that streams from the Johnson and Ammons team.

to seek inspiration in African, Oceanic, American Indian, and other primitive sources, as well as in the folk-art of Latin America. (Remember, for example, the recent Posada show at the Art Institute.) In music, a similar thing has happened over and over again. Brahms picked up inspiration from Hungarian dances which had, in Hungary, pretty disreputable connotations. Spanish rhythms such as the tango, the gypsy music of Andalusia, *cante honde* and *flamenco,* the folk-sources of Debussy's *Iberia,* all these are examples of music of folk-origin that has lived on to influence high-brow music.

As to the influence of jazz on serious music, I am not competent to speak. There is one composition by Alexander Tensman called *Sonatine Transatlantique,* with three movements, "Charleston," "A Spirtual in Blues," and "Fox Trot," which was written in 1926 and introduced into the U. S. by Iturbi. I am told that Stravinsky has been much interested in jazz, and that Darius Milhaud had said that he would sooner have written the St. Louis Blues than any of his own compositions. There are no doubt many more such items of information to be collected, but even if they were collected, I am afraid I should not be able to evaluate them, since I don't know enough about "serious" music.

But jazz musicians themselves have tried to go beyond the limitations of their form. An early attempt of this kind was by the famous ragtime authority, Scott Joplin, who in 1911 published an opera called *Treemonisha,* with words and music of his own composition. The latest attempt is, of course, Duke Ellington's composition, "Black, Brown and Beige." I have heard neither of these, but in between the two is one that I have heard, "Yamekraw," a jazz-rhapsody, composed by James P. Johnson in 1926. James P. Johnson is a pianist, now playing at the Pied Piper in Greenwich Village. His life spans the entire history of jazz. He has had first hand contact with the folk background and a formal musical education as well. "Yamekraw" is his most ambitious attempt at serious composition in the jazz idiom. It was performed over NBC in 1927; it formed the background music for some movie shorts. But since 1930, it has lain pretty much forgotten, except for the enthusiasm of such ardent musicians as Oro Soper. In order that you may have a chance to evaluate it for yourself, the distinguished young concert artist, Miss Elizabeth Jeffries, will sing it for you.

(EXAMPLE: Excerpts from "Yamekraw, A Jazz Rhapsody," by James P. Johnson. Elizabeth Jeffries, soprano, with Oro Soper at the piano.)

Jazz as an Expression of America

Just as in literature there are people like Edmund Spenser, whom we know as the poet's poet, and in art there are people like Piet Mondrian, who is a painter's painter, the musicians I have been discussing are, in the world of jazz, musicians' musicians—instrumentalists and singers who do the experimental work, who originate the ideas, who develop the conventions and the language, which others later dilute down to popular taste. The commercial successes, whether in poetry, painting, or jazz, are well known; the original sources of their ideas are often known only to serious students of the art in question. It is in jazz as in the other arts: that which we hear as "jazz" in the fashionable hotel orchestras and over the big networks is very rarely jazz as the serious student understands the term. Just as the great painting of our day is not to be found on magazine-covers staring out at us from every newsstand, so the great jazz music is not to be found by turning your radio on at random. The original work, the serious work, has to be hunted out.

This is not to disparage the importance of popular acclaim; but as

Albert Ammons is responsible for the other 50 per cent of the "Boogie Woogie King's" popularity.

you all know, those who contribute most originally and directly to an art and those who attain popular acclaim are by no means necessarily the same people. What I am merely trying to do here is to indicate clearly that I am not talking about Paul Whiteman or Guy Lombardo or Kay Kyser, important as these peole may be to their respective publics. I am talking about the men and women, many of them uncelebrated except among small coteries of serious enthusiasts and musicians, some of them unknown even by name, who are responsible for the development of this strange new musical art, which in spite of academic and moralistic disapproval, is becoming the art by which America is known.

The human spirit, even in Chicago's South Side, proves itself to be unextinguishable; poverty, slums, permanent depression, and lack of musical education were not enough to kill the artistic genius of the untutored pianists, the blind guitarists, and the men

who could make even a washboard sing.

Sometimes an outsider's praise is necessary before a group begins to appreciate its own accomplishments. In the case of the Japanese woodcut prints, for example, it was not until English, French, and American artists began to collect them and write enthusiastic articles and books about them that the Japanese themselves began to take pride in the men who produced them, such artists as Hiroshige, Utamaro, and Hokusai.

Before that time, the woodcut prints were regarded by educated Japanese as "vulgar." Their position in art was in some ways much like that of the blues in music: they were an extremely inexpensive form of enjoyment, they were available to everybody and hence loved by the common people, and finally, they often violated the dictates of upper class decorum.

The educated Japanese, therefore, did not see, until outsiders pointed it out to them, that the woodcut print was an amazing artistic achievement. Similarly, Negroes did not fully appreciate the blues and spirituals until whites began to sing them, collect them, and absorb them into their own musical expression. And American whites, too, didn't fully appreciate jazz (which has always been a complex blend of Negro and white influences) until Europeans like Panassie and Goffin and Delaunay began to make serious studies of the art.

In spite of the disapproval of musical officialdom, jazz, whose ultimate origin is the misery of an enslaved race, has spread all over the world. Learned books and journals devoted to its study were being published, before the war, in France, Holland, Switzerland, and Belgium. There were Danish hot-clubs in existence. Scholarly jazz magazines are still being published in England and Australia, as well as in America.

But it is not only the intellectuals who know America by jazz. In some strange fashion, jazz is proving to be a language that people everywhere like to hear. Langston Hughes has mentioned hearing the St. Louis Blues in Istanbul, where he says, it was the hit song the year he was there. It is to be heard any time in night-clubs in Moscow or Paris or London or Melbourne. Hitler, of course, found jazz to be one of the degenerate influences of which Germany had to be purged in order to attain the kind of spiritual exaltation his National Socialism stood for. Visiting Japan in 1935, I heard American jazz being played constantly on the bathing-beaches between Osaka and Kobe. It is not an accident, I believe, that the reactionary military group used to point to the college students' and urban young people's addiction to jazz as evidence of the collapse of national character. The easy-going manners, the spirit of skepticism, and the spontaneous gaiety which accompanied jazz did not sit well with the protagonists of Emperior-worship and the Old Samurai spirit. I am sure that one of the first acts of the Japanese government after the opening of the war must have been the calling in of all saxophones for use as scrap metal.

Today, millions of American soldiers, gathering around for jam sessions wherever they may happen to be, are educating the people of Europe, Africa, Asia, and the islands of the Pacific to the rhythms of jazz. Jazz is not merely a Negro expression. It is an expression of America, or at least of something very precious to Americans.

We in Chicago have every reason to be proud of the contribution to this art made by our great South Side. Our fellow citizens of the South Side brought to maturity the art which is proving to be our cultural ambassador to the common people everywhere. That rolling left hand that rocked the plaster off the ceilings in South Side flats will prove ultimately to be the hand that will rock the brotherhood of alligators all over the world.

(FINALE: "Jazzing Baby Blues," composed by Richard M. Jones. Richard M. Jones, piano; Darnell Howard, clarinet; Thomas Taylor, drums.)

The following articles appeared in Dr. Hayakawa's column in the *Chicago Defender.*

Albert Ammons and Pete Johnson

After having listened with rapt attention for years to various recordings made by Albert Ammons and Pete Johnson, individually and as a team, I finally got around last night to hearing them in person in a Chicago night club, Cabin in the Sky. What pianists they are! That powerful eight-to-the-bar rhythm is still beating in my brain this morning, and the fanciful high treble figures still flutter around in my head like swarms of chromium-plated butterflies.

Ammons and Johnson play facing each other across two small grand pianos placed back to back. They seem to pay practically no attention to each other. Ammons smiles around at his friends in one direction while Johnson is looking at his friends in another. Once in a long while they seem to notice each other, but they don't speak. They hardly even signal each other. Nevertheless, their strong hands beat the pianos at a furious clip, each player perfectly supplementing the other. One keeps wondering how they do it.

"Jivin' the Blues"

That perfect coordination is achieved, I believe, by their listening intently to each other. Having worked together since 1940 and being in profound harmony of spirit to begin with, they anticipate each other's every move. Once they have established their theme at the beginning of a selection, there is never even a split second of fumbling or inquiry.

Sometimes one embellishes what the other is doing. Sometimes the two pianos argue with each other, not like heated pro- and anti-New Dealers getting into each other's hair, but like brilliant but slightly demented conversationalists growing wittier and wittier as they respond to each other's brilliance. Sometimes the two pianos turn on their entire power and, ganging up on the audience, mow 'em down!

At the end of such a performance —as in "Jivin' the Blues," "Boogie Woogie Prayer," or "Sixth Avenue Express" it's the listeners, and not Johnson and Ammons, who are left gasping for breath. Johnson and Ammons go through the entire performance with practically no display of effort, Johnson moving his lips as he plays, as if talking or singing to himself, Ammons smiling with a beatific inward smile like the little girl in the Katherine Mansfield story who had just finished eating a chocolate cream-puff.

For Those Who Stay Home Nights

For the benefit of you miserable unfortunates who are unable to go to hear this piano team, I append a list of some of their recordings. Sit down and play some of these over and over to yourself, and learn something about what a piano can do.

The most readily available of Ammons and Johnson recordings is Victor Album P-69, "Eight to the Bar," which contains four records, all piano duets, with an added drum accompaniment. The best in this album is "Sixth Avenue Express" (with "Pine Creek" on the other side), which can often be bought singly.

In Decca Album 137, "Boogie Woogie Music," there is a solo record by Pete Johnson, with "Blues on the Downbeat" on one side and "Kaycee on My Mind" on the other. In Decca Album 235, "Boogie Woogie Music, Vol. II," there is another Pete Johnson record, "Basement Blues" and

(Continued on page 50)

NEW DEVELOPMENTS IN WIRE RECORDING

By

PAUL D. HERMANN

Like practical parents awaiting the return of Johnny Doughboy home from the wars, the staff at Armour Research Foundation of Illinois Institute of Technology is busy planning for the reconversion and orientation of the magnetic wire sound recorder into a new post-war world.

Drafted by the armed forces to help bring about a swift and complete victory, the wire recorder is efficiently going about its appointed task on far-flung battlefronts. But though the job facing it in war is certainly tremendous for a device still in "short pants" from point of age, the place it will hold in the world of tomorrow will undoubtedly be far greater by comparison.

Military censorship is a necessary hardship to the folks at home. To the line and staff connected with the Research Foundation, carving a peace-time niche for the recorder, the shroud of secrecy which covers its progress is doubly difficult to bear.

Pure speculation has evolved a number of applications to which the army and navy may be putting the war-time output. Certainly as a moral builder and maintainer, recording sermons, talks, entertainment, and even old familiar sounds back home (NBC recorded racket from subways, State and Madison traffic, bowling alleys, night clubs and even the stockyards for men overseas) the recorder has already proved its worth.

Orders, instructions, and observation that cannot be entrusted to radio may be recorded and dropped at headquarters by pilots, to be preserved or immediately destroyed by demagnetizing the wire after the message has been reproduced. The recorder could serve invaluably in instructing men regarding their duties and procedure in line of duty. In the execution and timing of verbal orders, it would be accurate and unfailing. And all incidents occurring during battle could be permanently recorded and preserved, as was done on Saipan.

Admittedly, commercial uses must be but a dream of the future while the war remains to be won. But the future is getting closer all the time, and potentialities can already be seen as realities even without 20/20 vision. Within a year after the war's end the 17 present licensees of the Wire Recorder Development Corporation, as well as many others which will be granted licenses to manufacture by that time, will be producing home radio recorders for civilian and industrial consumption.

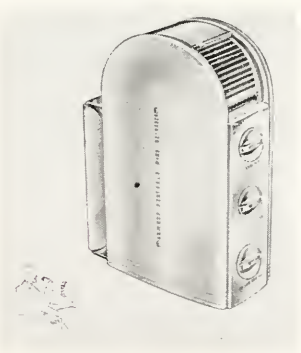

Fig. 1. Artist's conception of Pocket Model Armour Magnetic Wire Sound Recorder operated by rechargeable flashlight battery, designed by Product Designers, Chicago

Shown on these pages are a few of the "dream models" that have been conceived for the homes and offices of this not-too-distant tomorrow. Their uses in industry, entertainment, commerce and education will be practically endless. Only a few can be discussed here, but brief speculation is certain to uncover many more applications which would be individually both interesting and practical.

In the home, for example, the wire recorder will become an attractive and relatively inexpensive fixture. Professional recordings on wire will be made available, including vocal and instrumental music, lectures, extension courses and books. The sparkling clarity and naturalness of reproduction, which a wire recording features will greatly increase the pleasure and value to be obtained from such recordings.

Simplicity of operation will make the wire recorder a practical medium of home recording even for a child. Favorite radio programs could be recorded and replayed at any time. By equipping the machine with a timing mechanism, the recorder could be set for a given time and station, starting automatically, recording the program, and shutting off at its conclusion, without any operator present.

Messages might be recorded and left for absent members of a family. Rehearsals of speeches or music might be recorded at home to be played back for critical study and improvement. Children's sayings could be recorded for posterity on a permanent wire recording. Any number of events, such as family gatherings, picnics, conversations and so forth, may be recorded on wire at any place, regardless of location or climactic conditions.

In the field of office dictation, the wire recorder could be used efficiently at home or at the office. The pocket model, which is still in the developmental stage, would be particularly useful in this connection, since dictating could be done in hotel rooms, in motor cars, on shipboard, or on trains. Spools could then be dispatched to the office to be transcribed by typists.

Proceedings of a convention or conference could be recorded with unquestioned accuracy and the recorded speech or address delivered to widely scattered assemblies at the same time.

With the co-operation of the telephone company, a recorder could be attached to the telephone and take down messages. Its principal telephone use for the present, at least, would be to record telephone conversations where the law permits.

Using loud speakers or intercommunication systems, recorded safety talks, employee activity programs, talks on company policies and work schedules could be transmitted to all employees throughout an organization at any time.

And the overburdened sales manager could introduce sample lines or new models to the public by mailing spools of descriptive matter recorded on wire. Complete advertising campaigns could be effectively carried on through such a medium.

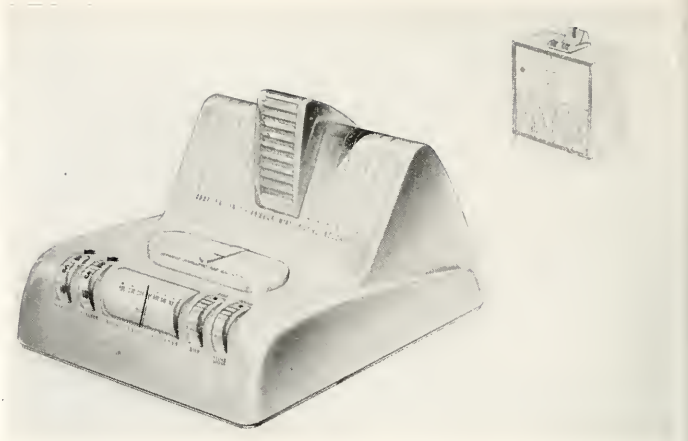

Fig. 2. Artist's conception (not a production model) of postwar Armour Magnetic Wire Sound Recorder adapter unit, which might be connected with existing radios, as shown in small illustration at right. Designed by Product Designers, Chicago

From an educational aspect, it is easy to visualize the wire recorder used to record any number of educational features, either for direct broadcast or for distribution to schools and colleges. Recordings of complete courses in history or languages, for instance, might well prove a practical medium for either home study or tutoring. Textbooks, literature, drama, lectures and addresses could all be recorded on wire for convenient playback, while program transcriptions could be made for exchange circulation among schools.

Uses of the wire recorder by law enforcement agencies would be equally varied. Police calls could be recorded so that officers, absent from their cars at the time, could hear the messages by merely playing back the wire on their return. Accurate testimony and descriptions could be obtained immediately from witnesses at the scene of any crime or accident. Permanent records of all court proceedings could be obtained by a single recorder in the courtroom.

On-the-scene recordings of newsworthy events, shortened and edited on wire to fit any allotted program time, would enliven radio news broadcasts and rebroadcast of special events could be carried out more simply and economically. The wire recorder would likewise have innumerable uses for newspaper reporters and radio broadcasters.

Undoubtedly one of the most interesting development projects being carried on at the Research Foundation is the experimental work in connection with the pocket model. This midget-sized unit ($7\frac{3}{4}$" by 4") is completely self-contained, the only connection

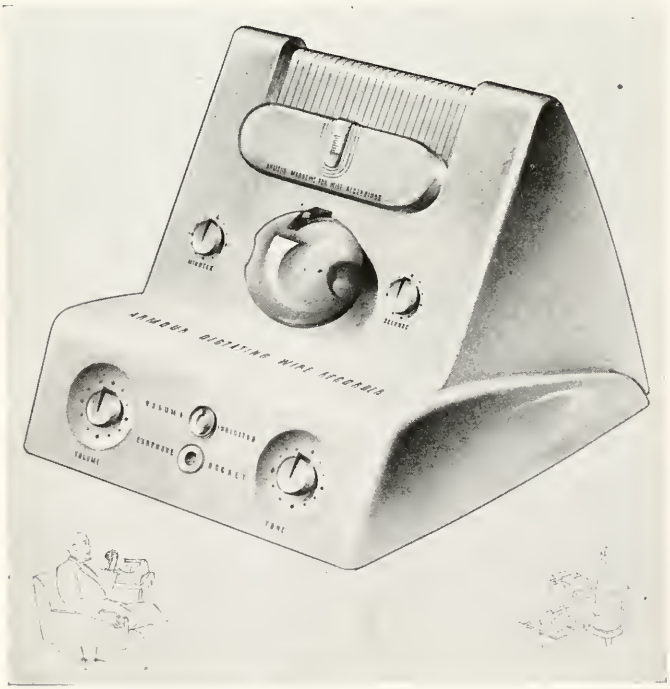

Fig. 3. Artist's conception of Armour Magnetic Wire Sound Recorder office dictating machine designed by Product Designers, Chicago

being with a small microphone which may be held in the hand, worn on a coat lapel, or clipped to the side of the recorder and used as a handy-talkie. A leather strap and carrying case allows this model to be worn as a camera or pair of binoculars.

The entire unit weighs only about three pounds and can record for 66 minutes at a wire speed of 1¼ feet per second with a .004-inch wire. At present this model records only and does not play back, necessitating the transfer of the wire spool to a standard model 50 to be rewound and reproduced.

In the pocket model both professionals and amateurs alike may find a device which will open up an entirely new field of candid reporting, comparable to the candid camera fad which raged a few short years back. Capable of recording any conversation, either with or without the speaker's knowledge, such a model might revolutionize the entire field of reporting.

The magazine model (Model 60) differs from the standard model chiefly in that a magazine, containing the wire spools, is loaded as a cartridge so that no threading of the wire is necessary. Such a magazine will be interchangeable on all machines, and may contain either blank wire spools for recording or recorded spools of professional music, entertainment or educational features.

This model is a compromise between the standard model and the pocket model as far as dimensions are concerned. Approximately 8 inches square by 8 inches high, it weighs about 15 pounds complete and will record for 66 minutes at a wire speed of 2½ feet per second.

Two other models, currently in the developmental stage with no photographs or specifications available, are now being tested at the Foundation. One, a master recording machine, is an exceptionally high fidelity model which will record professional performances for duplication by a multiple recorder on wire magazines for consumer use. The fidelity of this unit will make it useful in broadcasting and transcription studios.

After a recent experimental recording of the Chicago Symphony with this model, critical musicians who heard the playback said it was the most true recording they had ever heard.

The multiple recorder, also in its developmental phase, is designed to duplicate a master record on large numbers of wire magazines simultaneously for commercial distribution.

The wire recorder principle was developed by Marvin Camras, a former Illinois Tech electrical engineering student who is at present a member of the Armour Research Foundation staff. Camras was prompted originally to try to develop such a device to record the voice of his musically inclined cousin. Together they constructed the first, rather crude model at home in their spare time. Upon his graduation the Foundation became interested in his idea, added him to their staff, and began the development and perfection of the wire recorder.

Briefly, a .004-inch magnetic wire, nearly as fine as a human hair, is fed from one reel to another through a series of guide pulleys, passing through a magnetic recording head in the process. The input of the microphone is electronically converted into a magnetic field which magnetizes the

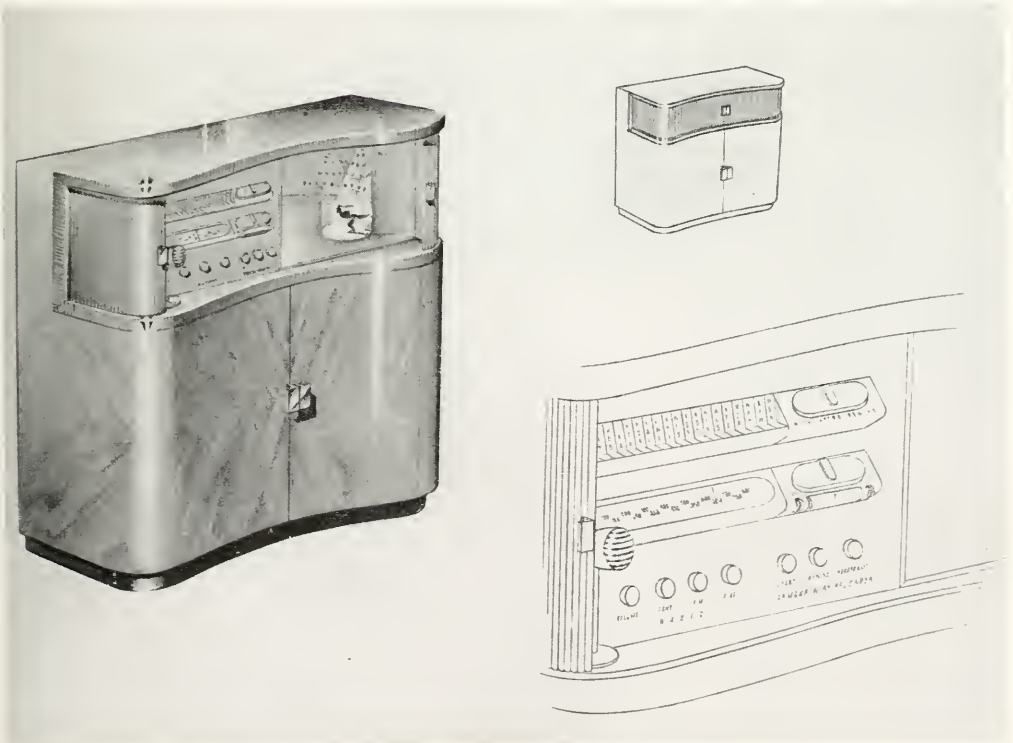

Fig. 4. Artist's conception of postwar radio-television combination console, containing an Armour Magnetic Wire Sound Recorder designed by Product Designers, Chicago

wire as it passes through the recording head, leaving a reproducible magnetic record of the sound which has been picked up.

When the recording operation is completed, the record can be played back immediately without processing. The wire is simply rewound on the first reel by reversing the motor. To play back, the wire is run through the recording head in the same direction as when recording the sound. The recording head acts as a pick-up and reproduces the sound.

Sound can be removed from the wire as easily as it was recorded. A demagnetizing coil, also in the path of the wire and placed so that the wire reaches that point before entering the recording head, can be energized by throwing a switch. As the wire passes, any message already on it is blanked out by a high-frequency electro-magnetic field which leaves the wire in a magnetically neutral state. Simultaneously, as the wire enters the recording head, a new message can be recorded.

A number of important developments have combined to make the Armour magnetic wire sound recorder successful where previous experiments, such as that of the Danish physicist, Valdemar Poulson, some fifty years ago, had failed. One of the major contributing factors to this success is that the recording magnetic field has been concentrated on a very small section of the wire to obtain good fidelity at low wire speeds.

In the Armour system the recording is made by passing the wire through an air gap in the recording head which can be made .001-inch or smaller, so that the field is extremely concentrated. Inside the magnet the field is negligible, and the wire is not influenced except at the gap. The rugged construction and long surface of contact with the wire reduces wear to a negligible value, and such wear can further be reduced by the use of inserts made of hard material.

The field acts with perfect symmetry if the wire passes through a hole bored through the magnet and, because of the longitudinal magnetization, rotation of the wire on its axis has no effect. Passage of knots and splices under such an arrangement is permitted by the inclined portion of the head which lifts the wire out of the slot and into a V-groove, where it rides momentarily until the knot passes. The wire then falls back into the slot and normal operation is continued. While the magnetic field in this head is not as perfect as in the ideal type, the approximation is good enough for most work.

Since no matter how perfect the recording system itself may be, a poor record material is incapable of responding to and accurately retaining magnetic impressions, much of the Foundation's work is involved in attempts to further improve and perfect this aspect. In addition to being perfectly uniform mechanically and magnetically, a good wire must have superior magnetic qualities in regard to residual magnetization, coercive force and energy product.

Wires that have been developed recently allow records of the same quality to be made at one-third the previously used speeds, and further improvements are very likely. The wire can be produced in quantity, and at such low cost as to be competitive with ordinary types of disk records.

There are a number of very positive advantages inherent in the Armour wire recorder which give promise for its success. There is no needle scratch which invariably accompanies the disk record after considerable usage, and it has an exceptionally low noise level. There is no break in continuity necessitated by changing records or turning them over. It is unaffected by extremes of temperature that affect other methods of recording and it is also comparatively unaffected by external vibrations and severe shock.

Unlimited reuse of wire is permitted by demagnetization of the entire recording, while any portion of the record can be erased or altered without harming adjacent portions. Other outstanding features include instantaneous play-back without processing, a minimum of background noise, an unlimited number of playbacks, longer recording time, excellent fidelity without elaborate precautions or special skills in recording, and the lightness, compactness and portability of the complete unit.

On April 1, 1945, the Armour Research Foundation activated the Wire Recorder Development Corporation in order to divest itself of commercial activities and devote itself exclusively to research and engineering development for industry. Headed by Lucius A. Crowell, the primary function of the new corporation is to take over all commercial functions related to licensing companies to manufacture the wire recorder. The corporation will also be in charge of providing special facilities for recording companies, assuring a wide distribution of recorded wire magazines as well as blank wire magazines, and generally expediting the entire program.

Armour Research Foundation itself does not engage in the manufacture of recorders. Production is carried out under a license agreement by manufacturers who pay royalties to the Foundation. The Foundation in turn expends their revenue in further research and development, the results of which are transmitted equally to all licensees. In effect, a considerable portion of the money paid in royalties goes back to the licensees, since they receive a recorder development service in return for it.

Under the licensing program which has been adopted, first consideration is given to manufacturers who are in a good position to contribute special skills in technical developments and are willing to make the expenditures necessary to carry these out.

Licensees are expected to standardize three things; the speed at which the wire travels so that all recordings will play back in correct pitch on any machine; the magazine which contains the wire so that it will be interchangeable among all makes of machines; and the diameter of the wire.

In order to clarify the licensing policy with respect to the wire recorder, the following statement was recently issued by Mr. Crowell.

"It is our settled policy to license the manufacturer of the completed machine, whether it be a radio receiver-wire recorder combination or merely a wire recorder.

"The licensee, however, has the privilege of subcontracting the manufacture of any of the parts of the wire recorder which he does not wish to make himself, and he may have these made either by a licensee or by a non-licensee.

"However, if a licensee wishes to subcontract any component parts of the recorder, we believe he will naturally prefer to have these parts made by a concern licensed by us and thus have the benefit of its experience and engineering developments in wire recording plus the Foundation's continuing service research and development in the fundamentals of wire recording."

In addition to Crowell, other officers of the corporation include: Dr. Jesse E. Hobson, vice-president; Raymond J. Spaeth, secretary and treasurer; and William M. Hammond, assistant secretary-treasurer. Crowell, Hobson, R. J. Koch, Thomas Drever, and Dr. Henry T. Heald constitute the directorate.

Without any question, the entire staff connected with the development and improvement of the wire recorder is doing an important job and doing it well. And as the wire untiringly wends its way to a speed of 2½ feet per second, they may well paraphrase the old song to read, "There's a long, long wire unwinding, into the land of my dreams. . . ."

THE CHALLENGE OF 24 HOURS A DAY

By

JOHN P. SANGER

Mr. President, distinguished faculty, graduates of the class of 1945 and honored guests. I came here today with this manuscript which I had planned to read to you. However, Dean Peebles met me in the hall and seeing this impressive document said, "For heaven's sake, John, don't read that thing! Don't you know that reading a speech is like making love to your girl through a picket fence. She can hear you all right, but the contact is bad." So I have decided just to talk to you.

First of all, men, I want to talk to you about the heritage which you have as graduates of the Illinois Institute of Technology. Heritage is a wonderful thing. The Marine Corps has it. Their song starts "From the halls of Montezuma, to the shores of Tripoli." When they go into action each man feels that a host of his predecessors are watching his every action and that he must live up to the grand tradition before him. The Navy has a similar heritage. The Army has one. You men at Illinois Institute of Technology have a heritage too. It is this that I want to tell you about, for as one of you I am extremely proud of it.

Armour Institute, which I know most about, was founded in 1893 by Philip Danforth Armour. He was a member of the Plymouth Congregational Church where Dr. Frank Gunsaulus, one of Chicago's outstanding citizens, was the pastor. One Sunday Dr. Gunsaulus preached a sermon on "What I Would Do with a Million Dollars." He told how he would build a college for young men who would otherwise have difficulty going to college and how he would coordinate the mind, the hand and the heart. His sermon was so inspirational that Philip Armour came up to the pulpit

John P. Sanger

afterwards and said, "Doctor, if you are willing to take the time to make your dreams come true, I will provide the million dollars." It was thus that Armour Institute was born, and all of us who have attended it know that this dream indeed came true.

Dr. Lewis, who founded Lewis Institute, had a similar dream. The charter of Lewis Institute provided that it should furnish education "to worthy men and to respectable females." The merger of these two institutions with their similar background of ideals was very fitting.

The men who have gone through these schools before you stand figuratively in the background today and wish you well. They are a successful lot of men, with real accomplishment behind them. I would like to tell you two quick stories about them.

The other day an ad was run in one of the Chicago papers, which read—"Wanted—one Harvard man, or equivalent." One of our graduates answered it this way, "What are you looking for—two Yale men, or four hours a day of an Illinois Tech man's time?" That was not said lightly, for I know that many companies do not care for the graduates of wealthy eastern colleges but prefer men from the smaller western colleges where hard work is the order of the day.

Recently another graduate who was directing a large war construction job was urging one of his sources of supply to complete some necessary parts much quicker than the man at the other end of the wire thought possible. The manufacturer snapped out, "Say, fellow, don't you know that Rome wasn't built in a day?" Our graduate shot right back, "I know that, but an Illinois Tech man didn't have that job!"

These stories tell of the heritage that you men have, for our graduates have accomplished the impossible time and again. This reputation for efficiency in getting things done that you inherit is the result of some very fundamental things.

You men have finished eight semesters of work. You have acquired a fund of technical information. If you don't remember it, you know where you can reach for it. You have learned that "talk cannot start the machine!" Let me repeat, you have learned that "talk cannot start the machine!" Think it over carefully, for as you go through life you will occasionally meet men who believe that talk is the all important thing. You may sometime, when watching the progress of others, come to believe that talk is all important. It never can be, for men who hold to that creed and cannot back up their words with results, fail.

The world of business demands re-

sults—not talk. Success in it is based on getting things done. Machines are started, plants are built, production records are made and sales are put across because of careful analysis of problems, careful planning and aggressive and smart execution of the plans, all in exactly the same way as you have learned to analyze and solve problems here at Illinois Tech.

The graduates standing back of you share with you a heritage of hard work. Armour Institute, Lewis Institute, and Illinois Institute have always had the reputation of being tough schools. No one has ever received his degree unless he really earned it. There are no snap courses here. Your heritage of having to really work for what you get is one of the finest things that any man can inherit.

You also have a heritage of common sense. I remember very well when we were studying "Power Plant Engineering" we used logarithmic tables to determine the efficiency of a boiler to the fourth decimal point. Professor Gebhardt caught us up on this the first time it happened with this sage advice: "How accurate do you think the instruments are that measure the flow of steam, the weight of coal and the percentage of CO_2? Why, you are lucky if they are within 2% of true accuracy. They may be less than 5% accurate! Use a slide rule. Save all that work." This rule of not carrying computations to a greater degree of accuracy than that of the instruments is a bit of common sense that has stood me in good stead for long years. You will frequently find men spending hours on analyses or computations that are utterly defenseless because of the inaccuracy of their basic data.

You have a heritage of idealism too. I know many of these men sitting behind me, and while they are probably the last men in the world to describe themselves as idealists, there is a salty integrity in every one of them that I am sure you have come to respect and admire during the last eight semesters.

I feel very fortunate to have attended Armour Institute during the time when Dean Louis Monin was on the staff. He used to teach classes called economics and history which were in fact the most pungent essays on the business of living that I have ever heard.

During my senior year I became an atheist for a short time. I had read Herbert Spencer's "Science and Religion" and it disturbed me mightily. My mother and father, my friends and some good church workers became very much concerned about the future of John Sanger. It was Dean Monin who set me straight by telling this brief story in one of his classes of economics. I pass it on to you.

An Arab and a Frenchman were travelling together in a caravan across the Sahara. The Arab was a devout Mohammedan, the Frenchman was an atheist. One evening they entered into an argument as to the existence of God. The Frenchman presented what he believed to be unanswerable logic. Said he to the Arab, "Can you see God?"

The Arab answered, "No."

"Can you hear him?"

"No."

"Can you feel him, smell him, taste him?"

"No."

"Well," said the Frenchman with a glow of triumph, "there can be no God."

They then went to sleep and in the early dawn the Frenchman awoke first. He walked to the door of the tent, looked out and remarked to the Arab who was just awaking, "I see the camel has been about." The Arab stood up with a smile and said to the Frenchman, "Can you see the camel?"

The Frenchman said "No."

"Can you hear him?"

"No."

"Can you feel him, smell him, or taste him?"

"No."

"Well, then, how do you know the camel has been about?"

"Why," replied the Frenchman, "I can see his tracks."

The Arab then took his friend by the arm, led him outside of the tent and pointed to the eastern horizon where the sun was coming up in the indescribable glory that can be seen only in the desert. "There," said the Arab, "are the footprints of God."

Looking over this room I can see that you men have another heritage that you are proud of—one that comes from other than the halls of Illinois Tech. I see your mothers and your fathers and your friends here. I see the pride on their faces. I know something of the cost and the effort they have put into helping you through these past eight semesters. You know better than I of this heritage. Your father and your mother and your friends join with a legion of prior graduates who smile proudly upon you today.

And now I ask you the question, "What are you going to do with this heritage that you have?" The better part of a lifetime stands ahead of you and you have just one thing to spend Each of you holds in your hands a commodity that is the most precious thing in the world. In your terms it is a tool, a sharp tool, which if you use it well, can carve a successful life for you, and which if you use poorly can cut you and can cut others as well. This commodity—this tool—is called Time. I would like to tell you a little about it. I quote Arnold Bennett who wrote an essay called "How to Live on 24 Hours a Day." This is what he said about time:

"Philosophers have explained space. They have explained time. It is the inexplicable raw material of everything. With it all is possible; without it, nothing. The supply of time is truly a daily miracle, an affair genuinely astonishing when you examine it. You wake up in the morning, and lo! your purse is magically filled with 24 hours of the unmanufactured tissue of the universe of your life! It is yours. It is the most precious of possessions. A highly singular commodity, showered upon you in a manner as singular as the commodity itself!

"For remark! No one can take it from you. It is unstealable. And no one receives either more or less than you receive.

"Talk about an ideal democracy! In the realm of time there is no aristocracy of intellect. Genius is never rewarded by even an extra hour a day. And there is no punishment. Waste your infinitely precious commodity as much as you will and the supply will never be withheld from you. No mysterious power will say: 'This man is a fool if not a knave. He does not deserve time. He should be cut off at the meter.' It is more certain than consols, and payment of income is not affected by Sundays. Moreover, you cannot draw on the future. Impossible to go into debt! You can only waste the passing moment. You cannot waste tomorrow; it is kept for you. You cannot waste the next hour; it is kept for you.

"I said the affair was a miracle. Is it not?"

I ask you this question, "What are you going to do with the time that lies ahead of you?" I would like to think through with you some of the possibilities.

Many of you men are in uniform and your time is cut out for you during the next few years. The armed forces of the United States have your program laid out and it is the fervent wish of us all that this future is so well planned that every minute will be used to the crushing disadvantage of our enemies. May you be home and in civilian clothes soon!

There is something else that I am

(Continued on page 34)

ARMOUR RESEARCH FOUNDATION

EXCERPTS FROM ANNUAL REPORT
FOR FISCAL YEAR 1943-1944

The eighth year of the Armour Research Foundation, while witnessing the same growth and expansion of public services which characterized earlier years, has been marked in several significant ways.

Most particularly it has been a year of self-analysis, inventory, and orientation. The progressive increase in research services to the Nation, its industry, and the general public, whose appropriations and contributions for this purpose have grown from $30,000 in the first year of the Foundation's existence to $1,668,845 in the year just concluded, and the extension of this service under the growing external demand for an organization of international scope, clearly indicate the need for careful planning and balancing of all phases of the work in order that the organization may serve to the maximum possible public benefit. Accordingly, this scheme, although popularly referred to *ad nauseum* as "post-war planning," was nevertheless the outstanding topic of this year's North Woods Summer Planning Conference. Out of this has come what is hoped to be a reasonably accurate estimate and recognition of the responsibility which the Foundation must bear in the coming decade.

The meeting of increased urgent demands for research service to our Armed Forces and their industrial suppliers has been absolutely necessary and must still continue at the expense of many civilian requirements. Toward softening the technical reconversion shock which must come, sponsors have been urged to plan their research for immediate military needs with a simultaneous regard for peacetime applications of the results where possible. The Foundation has considered that acceptance of additional research must be governed by efficiency limitations, lest all projects suffer through dilution of effort.

During the past fiscal year 117 long-term projects have been in operation, including 55 new investigations. Since the Seventh Annual Report 701 additional short-term studies have been conducted. To date, the Foundation has undertaken 262 major research programs, together with 5,504 short-term studies and special tests, serving a total of 1,615 large and small companies, associations of manufacturers, and governmental agencies. Ninety-four long-term industrial research projects are in operation at present.

While the war has created certain problems for all in the handling of research, it has served to accentuate others which would have existed to some extent in any case because of the rapid growth of industrial research activity. The effects upon scientific research now being felt as the combined result of the depredations of Selective Service, the virtual cessation of graduate training of additional research workers, and the general civilian manpower restrictions, have given a foretaste of what can probably be expected for some time in the future. Wartime restrictions and influences will naturally be removed as soon as possible, but the most serious damage has already been done; for, regardless of the military victory which now seems certain, over a considerable number of years immediately ahead the Nation must carry a staggering research load, far greater than anything heretofore witnessed; and it must somehow do this with a scientific army already deficient in numbers before Pearl Harbor and to whose ranks virtually none have been added during the war. It is true that our enemies and certain of our Allies have given this problem somewhat more careful attention and have taken steps to avoid the serious gap in scientific personnel supply which this country now experiences. Yet these other nations must also carry a proportionately increased research load, and therefore cannot reasonably be expected to provide any substantial percentage of the total personnel needed here. Since these facts speak for themselves, it has become clear that increase in research efficiency is the most important single problem now confronting research everywhere.

As a public service institution, the Armour Research Foundation has from the first considered "research on research" as an appropriate function in the public interest. But whereas until recently such studies have been motivated primarily through staff enthusiasm in whatever general contribution might be made, it is now felt that every possible ounce of effort in this direction is justified in the national interest.

The Armour Plan

The Armour Plan for Industrial Research, which in itself may be fairly regarded as an experiment in research technique whose study by the Foundation is now entering its ninth year, has received certain additional refinements as a result of this year's Staff Planning Conference. The basic plan, under which each problem is subjected

to the collective thinking and cooperative action of a large permanent staff of research workers in virtually every field of science, and in which every possible routine operation is removed from the research worker's responsibility and placed in the hands of auxiliary service laboratories, remains unchanged and continues to receive enthusiastic support of both research staff and sponsors alike. A method of graphic problem analysis was initiated experimentally shortly before the close of the previous year. Since then this aid has been developed more fully, and has been discussed before meetings of the Industrial Research Institute and the Minnesota and Chicago Sections of the American Chemical Society. It is to be presented shortly for publication in full detail.

A necessary minimum of formal procedure to supplement the daily informal contact by which group interchange of thought is effected, has been introduced to make the Armour plan as workable with the present staff of 300 as it has been in the past with a smaller number. At the same time there has been created a scientific liaison staff whose purpose is to provide representation of each major scientific field in the general activities of every other. This is to ensure, for example, that the electron physicist will have up-to-the-minute information on all advances made in the Foundation's chemistry laboratories which can in turn be applied to a physics problem, and vice versa. Still using this illustration, such a member of the liaison staff is not simply a chemist employed on the staff of the Physics Section but is a bona fide member of the chemical research staff who, relieved of specific responsibilities in individual research problems, is able to devote fully half his time to close contact and attendance at all meetings of the Physics group.

New Engineering Research Building

Construction has been started and two units occupied in the new Engineering Research Building, the second of the three large buildings which will eventually house the entire main laboratories of the Foundation. This building when completed will cover an entire city block, and is of one-story construction with uniform 20-foot ceiling height except for those portions which require more head room. The two contiguous portions, now in full operation, provide an additional working area of approximately 25,000 square feet.

Housed in 10,000 square feet of this new building is the Engine Research Laboratory, whose greatly increased research commitments have necessitated removal from its previous location to allow for the necessary expansion. In addition to its general facilities, this laboratory has provision for simultaneous operation of 20 internal combustion engines, and at present has 16 gasoline and Diesel engines in operation, including both single and multiple cylinder types with piston diameters from 2.5 to 12 inches. Twelve of these engines are equipped with dynamometers. Largest of the group is a Fairbanks-Morse single cylinder Diesel of the two-stroke cycle type, of 12-inch bore and 15-inch stroke, installed for engine component studies. The laboratory includes eight partially soundproofed cells for individual engine operation. Two of these cells are totally enclosed and equipped with adjustments to permit observations under controlled atmospheric temperatures. Large windows are provided in these cases, so that it is possible to take readings and observe engine performance under extreme conditions without entering the working zone.

Throughout the Engine Research Laboratory the electrical dynamometer connections, cooling water pipes, fuel lines, engine exhaust, and other connections are conducted through underfloor channels, eliminating all overhead obstructions which might interfere with the operation of the movable A-frame cranes which are used to move, repair, and handle engines and other research equipment.

In the construction of this new Engine Research Laboratory, a new type of engine mounting designed by the Foundation's staff has been employed. Set flush with the floor surface, each bedplate is weighted with a large block of concrete and the whole is suspended in the floor-well by rubber, bonded on each side to steel and loaded in shear. These mountings have proved themselves a very satisfactory answer to the problem of floor and building vibration so often found in laboratories of this type, and are contemplated for additional uses elsewhere in the Foundation as well as in certain laboratories in other parts of the country.

The Foundation's main Machine Shop, also moved from its previous location for purposes of expansion, has been installed in 7,000 square feet of this new building. As a tribute to the energy and ingenuity of the shop staff, it is fitting to record that the task of moving this entire machine shop was accomplished in two working days, without accident, and with every machine in full operation on the third day. In addition to the large general area containing all of the lathes, millers, shapers, drill presses, and other machine tools, as well as individual work benches, the new shop includes an office and blue-print room, a stock room, a two-level tool room, a grinding room, and a welding, flame-cutting, and final assembly room. This last, equipped with an electrically operated overhead track crane and an ample doorway, is designed for assembly or repair of unusually large and heavy apparatus. All of these shop facilities are in operation except the grinding room, space for which is temporarily occupied by additional machine tools connected with specific research studies.

These first two units of the new Engineering Research Building also contain 1,000 square feet of additional Ceramic Laboratories, several fundamental research laboratories in heat, electricity, and aerodynamics, a reference library, and the headquarters of the National Registry of Rare Chemicals. Also included is a spacious interior truck-loading area, situated for direct service to both the Machine Shop and the Engine Research Laboratory and equipped with a 3-ton overhead track crane extending throughout its length.

Other New Facilities

The Ceramic Kiln Building completed during the year has provided 2,000 square feet of laboratory space for heavy operations in mineral technology. In this building the floor, apparatus installations, network of subterranean flues for carrying hot exhaust gases from seven kilns and furnaces to the main stack, and the stack itself are permanent. The walls and roof, however, are of temporary tile and wood construction. Built early because of need, but situated in its proper place in the over-all plan, this laboratory is to be enveloped by the advancing construction of the Engineering Research Building, at which time it will be integrated with the other ceramic laboratories included therein.

Removal of the Engine Research Laboratory and the Machine Shop to their permanent quarters has made available a substantial amount of space in the earlier engineering building at 33rd and State Streets. This has permitted a major expansion of facilities in Chemical Engineering and in Engineering Mechanics research.

Taking advantage of the underfloor ducts and bedplates formerly used by the old Engine Laboratory, the Chemical Engineering Section has installed a sizable unit process laboratory.

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TECHNOLOGY CENTER 1993

A LOOK INTO THE FUTURE

By

ANONYMOUS

(*From the June 19, 1993, issue of the Chicago World*)

At the commencement exercises of Illinois Institute of Technology held yesterday in the auditorium of the Student Union at Technology Center, 501 graduates received bachelor's degrees at the celebration of the Institute's one hundredth anniversary.

Of these, 408 were in engineering and 93 in the arts and sciences. In addition, the degree of doctor of philosophy was conferred upon four persons and that of master of science upon twelve others. Ten honorary degrees were bestowed.

Among those present was President Emeritus H. T. Heald who flew in from his home in Washington for the celebration. His party had landed at the Lake Michigan airport off Twenty-first street shortly before the ceremony and had been met there by a delegation of students, faculty, and trustees. During a short period at the Faculty club building at Wabash and Thirty-fourth streets, he was asked for comment on the development of the big campus.

"No doubt it is difficult for you to visualize the campus a half century ago," he said. "It consisted of three buildings and two rows of what were called the 'Armour Flats.' Main building, Machinery hall, and the Mission had formerly housed the educational program. Then two rows of apartments were taken over and converted to our uses; one of them for research and the other for classrooms and laboratories.

"The Great World War in 1941 prevented us from realizing the new and visionary building program for a number of years since every ounce of steel, copper, wood, and other building materials was needed for the prosecution of the war. At the end of the conflict, however, we were able to start our march of progress.

"At that time, Technology Center was made up of the Illinois Institute of Technology, the Armour Research Foundation, and the Institute of Gas Technology. Lewis and Armour Institutes had combined in 1940. The other members of the family that is now called Teechnology Center have come into the picture during the second half century of progress. The old buildings were surrounded by a veritable slum district in which people lived in crumbling houses with the poorest sanitary conditions in the city.

"But some of those in the Institute's organization believed that the site could not remain forever in that condition," Heald continued. "The University of Chicago had been 'built so far out in the country that the city would never grow out to it.' Yet the fallacy of that statement has been proved over and over again. Industrial plants and institutions in many cities had been built upon the same false premise. In a relatively short time such intitutions see the residential areas leap not only to them but beyond them, due to the desire of the public to live in some place near their place of employment.

"Business offices, on the other hand, concentrated in such places as Pittsburgh's Golden Triangle, Cincinnati's Government Square, Cleveland's Terminal Square, and Chicago's Loop. The result was a ring-like growth, spotted by communities which had grown together. In Chicago, this growth was characterized by successive rings of wholesaling and warehousing enterprises, a poor residential ring, and an increasingly better residential ring which finally culminated in the thoroughly healthy suburbs. The whole was streaked through by such items as railroads, truck routes, river and canal routes, and old manufacturing plants.

"The central hub, the Loop, was slowly expanding, pushing the warehouses farther south and the poor residential district had to move before it. At Michigan avenue and Thirty-third street, a century-long cycle finally was completed. In the early days of Chicago, it had been a somewhat exclusive residential district. Our Graduate house of 1940 had formerly been the Cudahy mansion. The postwar building boom hastened the passage of the slums.

"Finally, the steady southward march resulted in the situation you see today. Our campus, from Thirty-first to Thirty-fifth streets and from Michigan avenue to the now-sunken and electrified Rock Island railroad, faces retail stores which serve the Center and the surrounding apartment houses which serve both the Center and downtown Chicago. The old elevated is replaced by the subway, State street's hazards have gone into the sunken Southside superhighway, and the bridges over the latter are wide and beautiful. The smoke and roar of steam engines and elevated trains no longer shake our foundations, nor compete with our lecturers. Our position as the only high-grade engineering school in a city that was large enough to support several, caused our leaders to believe that our location beside the strategic southward artery of Michigan avenue would someday be much like that of Columbia University on upper Broadway in New York.

"While the southward march of Chicago seemed painfully slow at times, when viewed in terms of quarter-century periods, the march was steady. We were prepared and ready when the postwar period accelerated the process and 1975 saw us well on our way with most of the buildings fitted into a pattern which, seen as

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APPARATUS FOR EVALUATING SURFACE ROUGHNESS OF COATED FABRICS

By

WALTER J. ARMSTRONG

The instrument to be described was developed during the course of an investigation of coated textile products for the Western Shade Cloth Company of Chicago, Illinois. It was desired to have an impartial and reliable method of checking and evaluating the surface roughness of various coating materials applied by different methods.

The roughness of a coated surface is important in a product such as tracing cloth. For example, if the surface is too rough pencil or ink lines will be ragged or "feathered." On the other hand, if the surface is too smooth, pencil or ink will not adhere to the cloth. Again, a suitable tracing cloth will exhibit no directional properties in the surface so that lines of uniform width and density can be drawn at any angle.

The method used in industry to judge surface roughness is the classical "thumb-nail" test. That is, the person judging the quality of the coating draws his thumb-nail over the surface and forms his opinion as to the roughness. This method hardly can be called impartial and reliable and provides no way of permanently recording the observation in numerical form.

Instruments are available at the present time having wide application in measuring the roughness of metallic surfaces. However, these instruments, which are effective in determinations as small as one microinch, rms., suffer two disadvantages when applied to textiles. The measurements are made over an extremely small area and the sensitivity is so high that unimportant variations in the surface tend to mask the desired result. Of the two disadvantages, the first is by far the most important. The measurement is made over a path only one-sixteenth of an inch long which means that for a fine fabric the reading would be taken from about six threads out of several thousand. For coarser cloth, as few as three threads would be covered. In order to evaluate satisfactorily the surface roughness of a large area of cloth, several hundred measurements must be made and to this end the development of a more suitable instrument was undertaken.

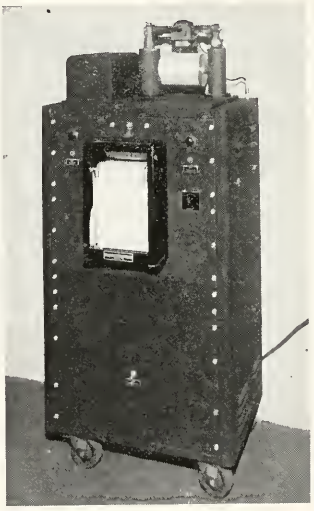


Fig. 1. Complete unit for evaluating surface roughness of coated fabrics. A needle "riding" the sample attached to the revolving roll at the top determines the pattern of roughness traced by the recording instrument just above the center of the unit

The completed unit shown in Figure 1 records the roughness of the sample under test as compared to some arbitrarily preselected standard which can be changed to suit the conditions for any particular type of coated fabric.

In operating the device a coated sample is secured to the roll shown at the top of the unit in Figure 1. During the test this roll revolves at approximately 40 revolutions per minute and, as the roll turns, a needle is lowered until it rides freely over the surface of the sample. The needle is in contact with a piezoelectric crystal which generates and feeds a pulsating voltage into an amplifier as the needle traces the contours of the coated material. The amplified signal is rectified and filtered before being fed to a recorder which writes a permanent record of the roughness of the sample under test. In making the sample record of tracing cloth shown in Figure 2, a path of over 30 yards is traced, although the total time consumed for such a test is less than five minutes.

It should be understood that this apparatus does not measure the absolute roughness of a sample, nor does it record each single variation in roughness; rather, it indicates the "roughness level" of the material under test. Although this "roughness level" cannot be expressed in inches, it does provide a means of comparing materials coated days or even months

apart. Thus, the degree of roughness can be used to check daily production of coated fabrics against a standard previously established to meet all specifications.

Although the instrument was designed to check uniformity of tracing cloth production, its use may be extended to all other coated fabrics or papers which have surfaces hard enough not to catch and damage the needle.

Further use may be made of the instrument as a research tool to evaluate the results of changes made in manufacturing procedures.

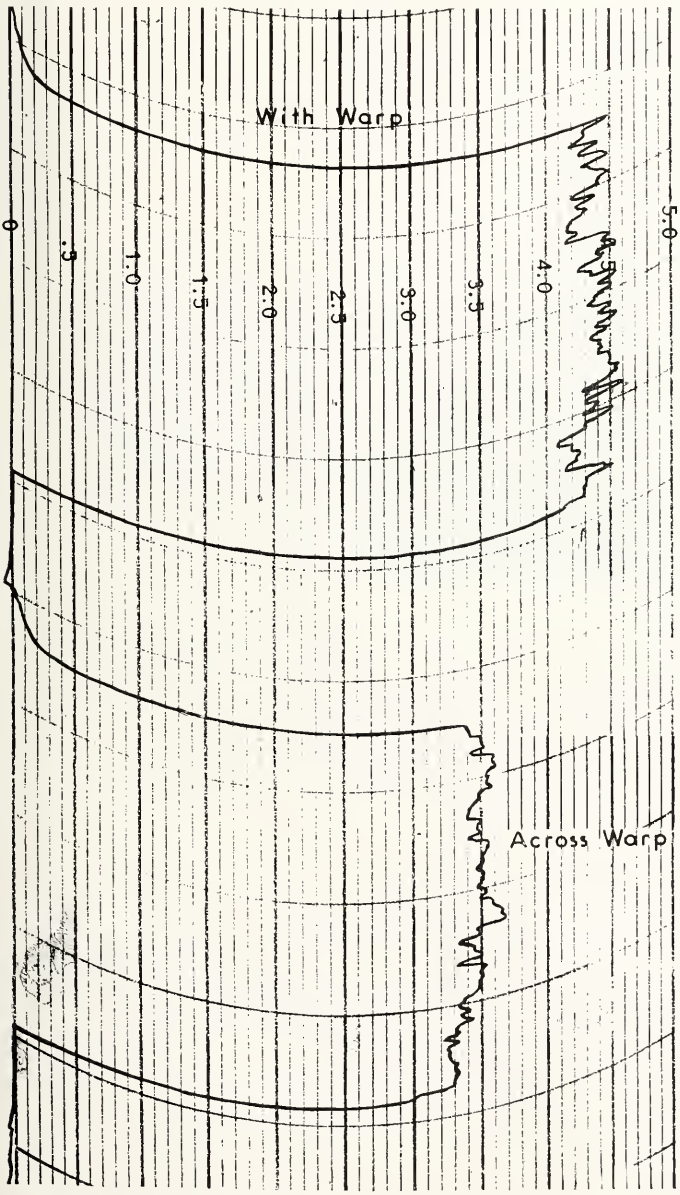


Fig. 2. The "roughness level" of a sample of tracing cloth as determined by the roughness tester

TECHNOLOGY CENTER—1993

(Continued from page 27)

a whole, was something big and inspiring, although the individnal buildings did not seem impressive when viewed alone."

The Technology Center architect then commented on the building program.

"The first of the new type classroom and laboratory buildings was not received with acclaim. Although large and roomy, with more space per dollar than previous college buildings, it was not decorative in its design. When the Administration and other buildings near Thirty-second and Dearborn streets began to supplement the Metallurgy and Chemical Engineering quarters, the wisdom of the overall plan began to be evident. The aspect of a college doing so much with so little seemed to intrigue the fancy of Chicago. The task of the Building Fund workers became easier, and the Armour Research Foundation and the Institute of Gas Technology found themselves in adequate quarters after over a decade of trying to work in old apartments and semi-permanent buildings. Now the Technology Center group ranks as one of the truly American contributions to university buildings. The architecture and size of the fraternity and sorority houses on Wabash avenue was, of course, controlled to fit into the picture; thus assuring both their financial and personal health."

The commencement procession started promptly at 2 p. m. in front of the Library and advanced slowly to the entrance of the Student union. On the platform were many friends of the Institute including trustees, presidents of the colleges, outstanding engineers and educators, a number of former members of the faculty and those on whom honorary degrees were conferred. One of these, an outstanding research expert, stated that he believed the contributions from Technology Center to the progress of scientific development had exceeded that of any other locality. New rocket fuels, new and stronger television methods, the piercing of the ionosphere, minerals from the polar deposits, electronic heat and power, and a host of less spectacular achievements marked the research efforts of the staff. New developments in teaching methods did not lag behind.

But the real story was told by one designated only as "Old Timer." In commenting on the main ingredients that made up the development, he said, "There is one such ingredient; get the right men and all the rest will follow. They will see to *that!*"

MAN OF THE MONTH

CLARENCE T. McDONALD

Many alumni take an active interest in the affairs of their Alma Mater, but Clarence T. McDonald, E.E. '04, has had an unusual reason for keeping in touch with his school. Of his seven children, four have attended Illinois Tech with three of them graduating. Clement graduated in '29 from the electrical engineering department, Leo received his mechanical engineering degree in '34, and Clarence, Jr., received his in '43. Ralph attended two years but his degree is from Notre Dame. Another son, James, will soon be a doctor having completed his medical training at Loyola. Two daughters, Helen and Florence, graduated from the University of Chicago and from Rosary.

During his senior year Mr. McDonald taught in the math department in the evening school. His first employment upon leaving school was with the Underwriters Laboratory. He later became associated with the old

McDonald and Sons

Chicago Fuse Company which is now part of the Jefferson Electric Company of Bellwood, Illinois. In 1913 Mr. McDonald and a group of members of the Chicago Fuse Company organized the Multi Fuse Company which was later re-incorporated with the parent company in 1918. It was at this time that Mr. McDonald organized the Multi Electrical Manufacturing Company. It is now located in a new factory at 4223-43 West Lake street. His company produces industrial and commercial lighting equipment—such as, fixtures for factories, stores, offices, schools and hospitals as well as flood lighting equipment. During the war the production has been largely devoted to the manufacturing of naval electrical lighting equipment.

At the present time Clement and Leo are associated with him. Clement is vice-president in charge of production and Leo is secretary and in charge of sales. The other three sons are in service. Ralph is in Germany, and Clarence, Jr., and James are stationed in this country.

Mr. McDonald and his wife live in Oak Park and have a summer home in Benton Harbor, Michigan.

NETWORK CALCULATOR

(Continued from page 12)

used to read either watts or vars with scales to match the scales selected for the ammeter and voltmeter. The figures on the watt-var meter scales can be arranged to be some multiple of ten times the kva base chosen for the study so that the values can be read directly in terms of system values, such as kilowatts or megavars.

The second set of instruments located just above the scaler instruments consists of a voltmeter and ammeter used for reading vector values. A standardizing current, adjustable to any phase position, is taken from a phase shifter, energized from the same three-phase source as the power sources of the network. The voltmeter will read the voltage in phase with this standardizing current or the voltage in quadrature with it. The ammeter likewise will read the components of current in phase with or in quadrature with the standardizing current. To determine the exact phase angle of any voltage, the shifter is turned until the quadrature standardizing current results in a zero reading on the voltmeter. Then the phase angle reading is taken from the dial of the phase shifter, which is located conveniently between the ammeter and voltmeter.

In the most common use of the equipment, engineers of the participating companies will assemble complete data on the system to be studied, including impedances of all circuits, voltages at various points, power being generated by all generating stations, and the magnitude and power factor of all loads. All of this information is reduced to calculator values. The circuits on the calculator are then connected in the same manner as the generators, lines, transformers, loads, etc., on the power system and adjusted to have equivalent characteristics.

(Continued on page 34)

Keeping America's Pantries well-stocked with wholesome food

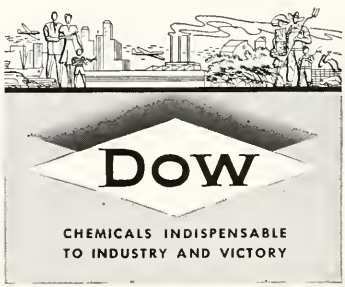
Chemicals protect crops — vital aid in processing and packaging

A well-filled lunch box—a bountiful home table—pantry and refrigerator well stocked with wholesome food—

That's an American custom and millions of people are on the job to see that this custom prevails. Nature provides sun and soil, air and moisture. Man contributes labor. And among his tools none is more essential than chemicals—notably spraying and dusting materials.

Special care must be taken to protect growing crops from destructive pests, and growers rely heavily on Dow insecticides and fungicides. Dow Dormant Sprays, such as *DN*-Dry Mix, and other products such as "Mike" Sulfur, *DN*-111, to control red mite. Bordow, Arsenate of Lead, Calcium Arsenate and Paris Green, have their special jobs to do in orchards, groves, fields and gardens.

Much of this food must be protected from infestations while in storage or en route in cars or ships, as well as in processing and packaging. Great quantities of Methyl Bromide, Chloropicrin, Dow grain fumigant mixtures and other chemical materials are required for such purposes. All these Dow products are produced so that a hungry world can have more and better food.



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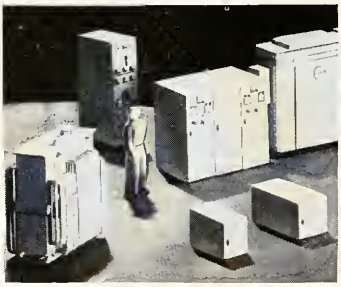
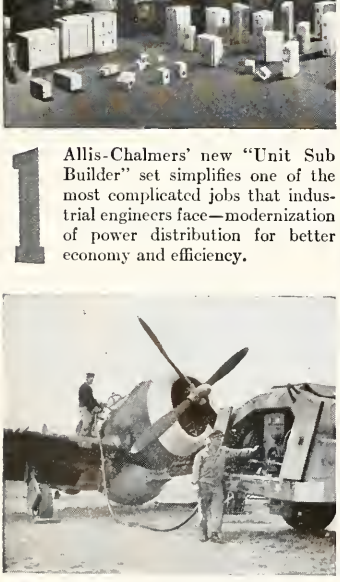
HOW THEY HELP SOLVE SUBSTATION PROBLEMS VISUALLY—SAVI TIME, PAPER WORK! TYPICAL OF A-C'S AID TO INDUSTRY!

1 Allis-Chalmers' new "Unit Sub Builder" set simplifies one of the most complicated jobs that industrial engineers face—modernization of power distribution for better economy and efficiency.

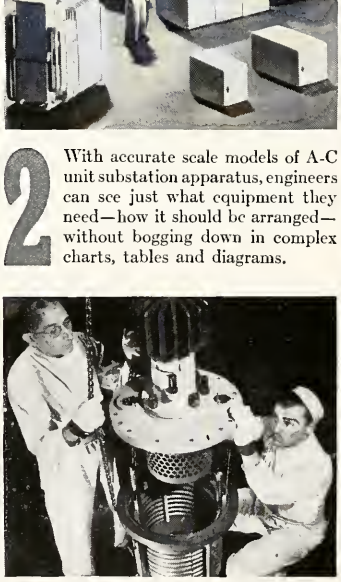


2 With accurate scale models of A-C unit substation apparatus, engineers can see just what equipment they need—how it should be arranged—without bogging down in complex charts, tables and diagrams.

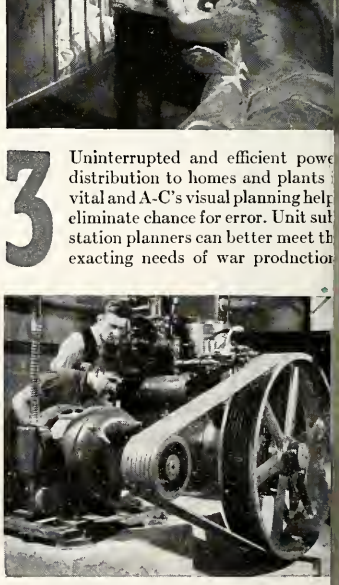
3 Uninterrupted and efficient powe distribution to homes and plants vital and A-C's visual planning help eliminate chance for error. Unit sub station planners can better meet th exacting needs of war productio



4 Helping produce super fuels for planes is the job of A-C Gas Turbines—another Allis-Chalmers' aid to industry. Today, A-C has more industrial gas turbines in use than all other companies combined.



5 Developed and introduced by Allis-Chalmers, single anode Excitron rectifiers provide simple, reliable conversion from a-c to d-c power for industrial applications—250 volts and up.



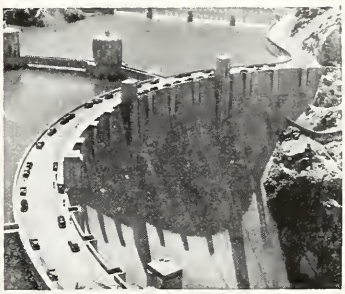
6 Still another basic A-C develop ment is the Texrope Drive. Throughout industry, this Multiple V-Be Drive, invented by A-C, transmit mechanical power that gives U.S its clothing, food, 1001 necessities

7 Even airports and highways are built with the aid of Allis-Chalmers. A-C supplies U.S.A.'s largest line of rock-crushing and milling machinery . . . tractors, graders and bulldozers for all types of construction.

8 The ability of Allis-Chalmers to solve almost any kind of industrial problem was demonstrated two years ago when turbo-superchargers were urgently needed by the U. S. Army for bombers and fighters.

9 Not only did Allis-Chalmers build a complete new supercharger plant in record time, but quickly trained hundreds of inexperienced workers to mass produce these highly specialized precision machines.

10 A-C engineering reaches into every industry. If you are a shipbuilder, A-C can supply you with steam turbines, pumps, motors, condensers, many other types of marine equipment.



11 At Boulder Dam, Niagara and Grand Coulee, A-C hydraulic turbines generate power for factories, homes, farms. Call on A-C's vast experience for help with *your* production problems!

12 Meet Mr. Bernard Pagels, one of many thousands of skilled craftsmen who insure the integrity and precision workmanship of Allis-Chalmers' products—over 1600 for U. S. Industry!

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

EXPERIENCE PAYS BIG! Today, with Industrial Background and Skill more vital than ever, it's important to know the Company with the widest range of Engineering Experience...

ALLIS-CHALMERS

PRODUCER OF THE WORLD'S LARGEST LINE OF MAJOR INDUSTRIAL EQUIPMENT

A-C

Tune in the BOSTON SYMPHONY
Every Saturday over the
Blue Network Coast-to-Coast
8:30 P.M. E.W.T.

NETWORK CALCULATOR

(Continued from page 30)

When all of the known system operating conditions are matched by values on the calculator, which can be read accurately at the meter desk, the entire setup is a correct representation of the power system. The voltages and loads on all circuits of the calculator can be measured accurately, giving information not otherwise readily available because measuring equipment is not usually available at all points on the power system. Changes can then be made, new lines added, new loads served, new generators put into operation, etc., and again accurate measurements can be made at all points to predict the effects of such changes. Transient studies can be made by using a step-by-step process, using the readings of one step to calculate the conditions that must be met on the following step. Less common, but very important to power systems, is the study of transient voltages that last only a cycle or two. These studies are made by reproducing the characteristics of the system on the calculator circuits and repeating the application of the transient rapidly enough by means of commutators so that the voltage wave can be observed on an oscilloscope.

Besides power system studies there are several other uses for the calculator. In some complicated problems of mechanical stresses, heat flow, and acoustics, the elements can be translated into terms of electrical equivalents and the resulting electrical system can be studied on the calculator. The extent of the possibilities in this direction has not yet been fully explored.

COMMENCEMENT ADDRESS

(Continued from page 24)

sure will occupy a lot of your time, too. That disturbing cause of sleepless nights, of worry, of the highest of dreams and the deepest of despondency; that greatest influence of men during the immediate years that you face, that which we cannot live with and which we cannot live without, that influence known as *woman,* will occupy a large share of your waking moments during the next few years.

Possibly some of you are already over the hurdle. How many of you men are married now? Raise your hands. How many of you are engaged? Raise your hands. Will the rest please raise their hands? Girls, here is your opportunity!

How many girls are in the audience who are either married or engaged to these men? Raise your hands, please. Let me congratulate you. Engineers for long years have had the reputation of making the best of husbands! Illinois Tech engineers are the elite of the entire lot! If you don't believe me, talk to President Heald's wife. I am even courageous enough to refer you to my wife. Adventure lies ahead of you, girls, just as it did for Osa Johnson. You will probably have the travel, the comfort and the ease that the gypsy fortune teller told you about. You will certainly have the undivided affection of as fine a group of men as can be found. For, once these fellows have selected the mate for the rest of their lives, they have the reputation of keeping so busy with design, with construction, with operation and even with selling that they have no time for any other woman but you.

Permit me to be the class prophet for a moment or two. I can't recall you by name but as I look over the group I am sure that there are men that I see before me who will reach positions of great power and who will undoubtedly accumulate fortunes that will be envied. I'd like to tell your fortune. You will buy that power and that fortune with the commodity I have just described—time. You will work hard. You will probably take work at night school to supplement what you have learned here. You will read all of the available literature about your profession. You will do a lot of traveling. You won't get much sleep. You will spend long hours with the men under you. You will spend even longer hours with those from whom you buy or to whom you sell. You will probably take up golf and bridge and poker, for these seem to be necessary tools in the social scheme of things today. Sure, you will marry, but you will be known as the man who comes home on week ends and sleeps most of Sunday. Your children will live a life of luxury but the chances are that they won't really know Dad. Your wife will get used to this kind of life and after the first year or two will stop arguing about it. You will have few hobbies and when the time comes to retire you will wonder what in the world you are going to do with all the time on your hands. You will have bought power with your time, and fortune, but you will have paid a dear price for it.

There is another and larger number of you who will buy a thing called happiness with your time. I'd like to tell your future also. You will probably live comfortably. The heritage that I just spoke of will see to that. The odd part of it is that you will buy this happiness by giving time away. You will spend it with the family. You will remember your wife's birthday, and you won't forget your wedding anniversary. You will take the boy fishing and when he gets older you will show him how to hunt. You will take your daughter and her friends to Saturday afternoon matinees, and her friends will wish they had a dad such as you. You will spend no end of time with your friends.

Strangely enough, you fellows will probably look at those who buy power and fortune with their time with some envy. Stranger still, these men will probably envy you, too. I suggest that you strike a medium between these extremes and really live.

All of you have been buying one thing with your time during the past four years that you probably don't appreciate now. You have bought friends with your time. I am sure that each of you can name two or three fellows in this group who really qualify as your friends. I can look back 24 years ago this June when I graduated in this same room. Spence Havlick, Al Hoven, Bob Van Valza and I were a team who went through the last two years together. We sweated through machine design, steam generation, refrigeration, and the other subjects which you know so well; we had endless bull sessions; we talked about life and what it held for us and we spent a lot of time talking about the kind of girls we were going to marry. I number those three men today as among the best friends I have and it was only recently that I realized that I bought this friendship with the time which was at my disposal when at Illinois Tech.

Cherish these friendships well, for you will have trouble in finding the same amount of time to buy friends with in the future.

Lastly, you will buy something else with time which is very precious and which you don't ordinarily think of as so purchaseable. You will buy memories with time. As was so ably told in the play, "You Can't Take It With You," that is really all that you have bought when you come to the end of your span of years.

I have some very dear memories of four years spent on this campus. I remember Dean Monin and the inspiration he was to all of us. I remember Dr. Gunsaulus. I was editor of the Armour Engineer the year that he died and it was my task to secure the obituaries which were published in the Armour Engineer. Those gave me an appreciation of the power and

the idealism back of this school. I remember the class elections, for I was a "barb" not being able to afford a fraternity and our class politics were just as realistic as those which Ed Kelly practices today. I remember some long walks on spring mornings when we occasionally ducked classes and strolled down to Lake Michigan. I remember the "Shoe and Sock Pullers" Society when the seniors would select a junior, overwhelm him, take his shoes and socks off and carry them from this building across the street and lay them in front of Dr. Gunsaulus' door on a cold winter day.

I remember our wedding ceremony. I remember even more vividly the first time my wife was taken to the hospital and I stood by her bed as she came out of the ether. Somehow the reality of married life and all it can mean became crystal clear then.

I remember the time we were in Europe and on a Sunday afternoon went to a church service in Stockholm. It was a musical service. We were 4,000 miles from home and couldn't understand a word of the Swedish language, but the tunes were familiar and we caught the "Jesu" as it was sung in Swedish. It was then that there came over me the realization of what the phrase "The Brotherhood of Christianity" really means. I didn't know a man there—but a common bond held us together.

Each of you has memories that you have bought with time here. As the years go by you will buy many more and they will be among the most precious possessions you have.

In conclusion I want to tell you two more short stories.

When I was nine years old I lived in Wyoming, Ohio. It was the town of the white collar workers from Cincinnati. Across the railroad tracks was Lockland, Ohio. It was the mill town where the working men lived. Wyoming was dry, and Lockland was wet. There lived in Wyoming a lovable, weak-willed fellow named Bill Smith, whose habit every Saturday was to go over to Lockland and get gloriously drunk. Three of us were out late one Saturday night and were exploring the creek near the railroad bridge. Bill was on his way home and we could see him weaving back and forth across the track which was the shortest line from the saloon to the cottage where he lived. His progress looked like the sine curve which you men know about.

Shortly he came to the bridge which had no hand rail but which did have a 12-inch board running down the center of the track for the convenience of pedestrians. Bill came to the edge of the bridge, stopped, pulled up his trousers, straightened his shoulders, got a firm grip on himself and to our complete surprise walked across that 12-inch board as straight as a string and with the stride of an Army general. As soon as he was across, he relaxed and again wove from side to side on his laborious way home.

It was clearly evident that when Bill Smith really wanted something hard enough he accomplished it. That same opportunity is open to you. The path of your life can be a "Sine curve," or a straight line. It is simply a matter of decision, and whether you want whats at the end of the straight line hard enough.

The second story is about a man named R. H. Conwell. When he was in the Civil War his best friend was killed at his side. He then and there resolved to live two lives instead of one.

He was the author of a lecture that is reported to have earned more money than any lecture ever given in the history of time. It was called "Acres of Diamonds" and the proceeds from it built Temple University.

"Acres of Diamonds" is the story of the Arab who early in life resolved that he would find and own the greatest diamond mine in all the world. He sold his house, left his family and travelled for years in all climates and throughout the world prospecting for diamonds. His search was unavailing, and finally, old in years, cess, he found his way home to die in the surrounding he grew up in. There, to his utter amazement, he found that beneath the very home he had sold when he left on his quest was the famous Golgotha diamond mine, which had been discovered when he was away and which had brought untold riches to its owner.

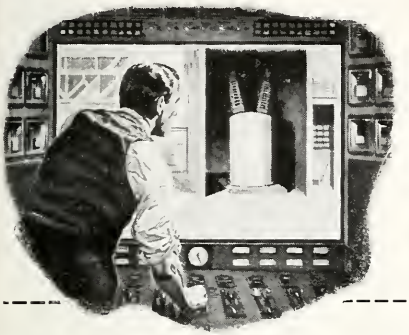
R. H. Conwell pointed out that time after time life is very much like that. Your opportunity is wherever you are and it is not necessary constantly to seek green pastures to find success.

Men, it has been fine to have talked to you. As you look back on this talk, remember I haven't told you that you are the finest lot of men ever graduated. I couldn't, because I don't know you, and if I did I probably wouldn't anyway. I haven't told you that the world is yours for the asking. Some of you may think so — during this manpower shortage — y o u ' l l come down to earth soon.

I have told you of your heritage,

In a field hospital, a SURGEON uses a new x-ray machine that marks the exact location of the bullet, speeds life-saving behind the battle line.

. . . the name on the X-RAY MACHINE is Westinghouse.



In a laboratory an ENGINEER uses the instantaneous power of 75,000 thunderbolts to test giant circuit breakers that protect America's power systems.

. . . the name on the CIRCUIT BREAKER is Westinghouse.

In his tent a SOLDIER uses a bug bomb to destroy insect life — safeguarding health and increasing comfort in tropical jungles.

. . . the name on the BUG BOMB is Westinghouse.

In a war plant a WORKER uses an electromagnetic device to detect flaws in heat-treated bearing races — keeping our combat vehicles rolling on to victory.

. . . the name on the ELECTROMAGNETIC DEVICE is Westinghouse.

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

TODAY—Westinghouse products are serving in every battle, on every front, in the war against aggression.

TOMORROW—New processes and new materials...created under the stress of war . . . will mean better and longer-lasting Westinghouse products for a world at peace.

Tune in: JOHN CHARLES THOMAS—Sunday 2:30 pm, EWT, NBC. TED MALONE—Mon. Tues. Wed. Evening, Blue Network

and it's a grand one, but other men have grand heritages, too.

I've also told you of the most precious possession you have—time—twenty-four hours a day. May you use it well! May you all succeed—and may you also find much in happiness, friendship and memories along the way!

Best of wishes, fellows, and good luck!

ARMOUR RESEARCH FOUNDATION

(Continued from page 26)

Much general utility equipment of plant scale and semi-plant scale has been centralized here, including a large glass-lined power-driven mixing kettle, filter press, steam-heated tray drier, rubber mill, paint mill, rotary particle classifier, hydrizing furnace, wide-range, high-frequency heating equipment, and related units. Included in this laboratory is an enlarged pilot plant for starch studies, and also corrosion equipment such as the standard salt spray cabinet and a double-arc Weatherometer.

The Chemical Engineering Section has also doubled the size of its pilot plant for fiber and paper studies. At the same time it has added a newly equipped two-unit electron-chemical laboratory with independently air-conditioned working space. A special feature of the latter is an extremely versatile, highly kinetic vacuum system, unorthodox in that it employs 15 removable joints and yet produces a vacuum of less than 10^{-6} mm. of mercury without the use of liquid air. The design of this system is to be published in the near future.

The Engineering Mechanics Section has now consolidated its major activities in the State Street Building. As this section designs and builds considerable special-duty electronic equipment for use in strain study and in connection with the various other research projects throughout the Foundation, facilities for this work now include a new electronics assembly room and an electronics equipment testing laboratory. A portion of the space in the State Street Building has been devoted to numerous new smaller laboratories, work rooms, and offices, in Mechanics. Also, the stress laboratory has been shifted to larger quarters in view of the expansion of work in this subject.

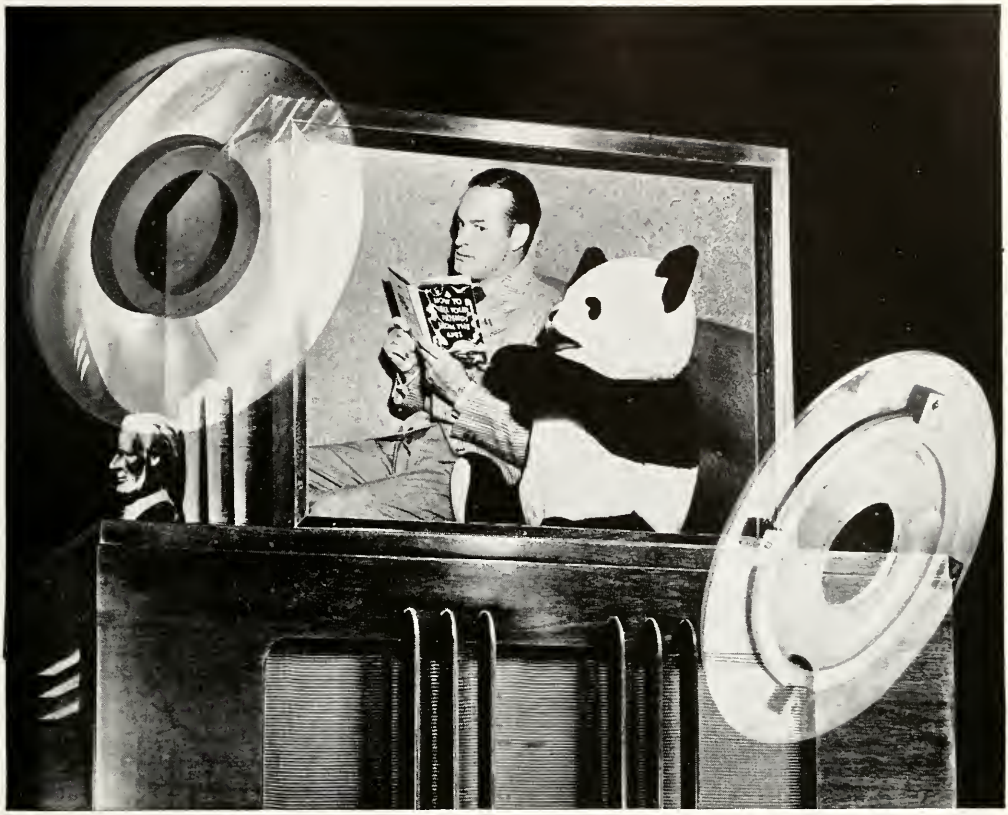
Of unusual interest are two new mobile field trailers for stress studies. These two units together constitute a complete and self-contained laboratory. With their use, it is a very simple operation to move to the field for strain measurements on bridges, ships, and other large structures without the usual prolonged preparation at the main laboratory as well as at the place of measurement. The larger of the two has multiple-channel facilities for both electronic and X-ray strain measurements, complete with 16-mm. photographic recording equipment; this mobile stress laboratory also contains a small heating plant, a darkroom, an operator's control desk, and a light work bench. The second unit is the service trailer, carrying 2,500 feet of shielded cable on special cable racks, a portable X-ray diffraction unit with its accessories, and a motor generator set for supplying power in the field, together with a variety of large and small tools. Although these are not the first mobile laboratory units to be used by the Armour Research Foundation in its work, they are the first to be considered as permanent equipment. Kept ready for immediate use at all times, they are designed so that they can be rolled into the Foundation's Main Mechanics Laboratory and operated for strain measurement purposes there as well as in the field.

A new enlarged extreme pressure laboratory has been placed in operation in the State Street Building. Provided with a universal overhead crane for handling the heavy apparatus involved in this work, this laboratory already contains equipment for the study of chemical and physical properties of materials in the range of 1,500,000 pounds per square inch, and additional facilities are being installed to extend this range into several million pounds per square inch.

In the Main Building, the Physics Section has acquired additional laboratories in electronics, X-ray diffraction, photo-elasticity, color photography, and spectrography. A new Abney-mounting spectrograph suitable for work throughout the ultraviolet, visible, and infrared ranges has been installed. This building has also acquired a greatly enlarged chemical storeroom, as well as a separate physical storeroom.

Within the Metals Building have been constructed new darkrooms for study in X-ray diffraction and metallography, as well as development of film from these operations. For the special metallurgical needs in X-ray diffraction, the Foundation has built a unit employing molybdenum-, copper-, iron-, and cobalt-target tubes, any three of which are mounted simultaneously; power may be shifted quickly from one tube to another without disturbing camera alignments.

For numerous reasons of conveni-



RCA Laboratories model with an 18 by 24-inch screen showing how Bob Hope may appear on future home television.

New Projection Television - Bob Hope's face "big as life"

Can you picture Bob Hope on television . . . seeing his face *big as life*—right in your own living room?

Well, you will—for now, thanks to RCA research, all limitations on the size of home television screens have been removed.

RCA Projection Television sets can have 18 by 24-inch pictures, or for that matter, pictures as large as the screen in a "movie" theater!

When you tune in an NBC television broadcast you'll almost think the actors are in the same room with you—and trust NBC. America's No. 1 network in sound broadcasting, to bring you the best in television entertainment.

This revolutionary improvement was achieved in RCA Laboratories by development of an entirely new reflector and lens, shown in phantom above. This lens, of inexpensive plastic, is 8 times as efficient for the purpose as the finest optical lens.

When you buy an RCA radio, phonograph or television receiver—or any other RCA product—you receive the benefit of the latest research development of RCA Laboratories. It is this *plus value* which is your assurance of lasting satisfaction.

The widespread public recognition of this plus value has given to RCA world leadership in the radio, phonograph, television and electronic art.

Dr. D. W. Epstein with a projection television tube, reflector and lens unit. Here the image on the end of the tube hits the reflector, is corrected by the lens, projected to the screen, then enlarged . . . making possible larger and clearer television than ever before.

RADIO CORPORATION of AMERICA

PIONEERS IN PROGRESS

RCA

ence, and especially to provide headquarters for the expanding activities in magnetic wire sound recording, the Foundation has opened loop offices in the Field Building on La Salle street. Experimental sound recorder production operations have been moved to space in a factory building on the near north side of the city.

Foreign Field Research

The Foundation's Industrial, Technological, and Economic Survey of Argentine Industries, completed some months before the 1943 military revolution in that republic, has been published in English in the form of a 400-page book, and has been placed in key libraries and governmental offices throughout the United States through the courtesy of the New York office of the Corporación para la Promoción del Intercambio, which sponsored the work. Including analyses of the technological status of industries in jute, hides and leather, refractories and ceramics, dairy products, grains, chemicals, forest products, vegetable oils, and fuels, as well as detailed studies of the Argentine economic structure, available resources and scope of the market, factors conditioning Argentine industrial development, the problem of policy, technical education, applied technology, and an outline for the possible establishment of local research facilities, individual portions of this study have been published also in Spanish and distributed by the Corporación para la Promoción del Intercambio in Buenos Aires.

The Foundation has been commissioned to make a somewhat similar technological audit of Mexican industries, under the sponsorship of the Banco de México, with initial industrial emphasis upon fibers and their industrialization, hides and leather, coal, coke, other solid fuels and by-products, and forest products in general, together with the necessary related industries, resources, and technological aspects. From the Foundation's field headquarters in Mexico City, the work will involve careful study of all regions of Mexico from this standpoint, in close collaboration with Mexican technologists.

As a further aid to Mexican industrial development, the Foundation has arranged for a number of outstanding young Mexican scientific men to come to the United States for a number of years' work in Foundation laboratories, supplementing this with advanced graduate training in any of the universities or technological institutions in the Chicago area.

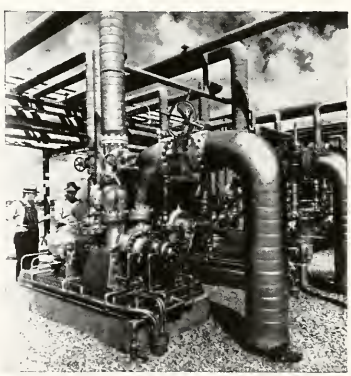
More Gas to the Sand at Higher Pressure with 12,800 H. P. of Clark "Angles"

● The new recycling plant of the Texas Company at Erath, Louisiana, breaks all previous records by returning gas to the formation at 4650 lbs. pressure. The design and manufacture of the 16 Clark "Angle" Compressors for this job called for precision engineering and workmanship of the highest order. Compressor cylinders were designed to meet the exact operating conditions to which they would be subjected. Extremely close tolerances had to be maintained.

The basic economy and dependability of the Clark 2-Cycle "Angle" is demonstrated once more in the most modern type of plant.

INSTALLATION SHOWN AT THE RIGHT *is a battery of Pacific type H.V. Centrifugal pumps delivering peak efficiency in De Tentanizer furnace feed and lean oil service. Type H.V. handles extremely hot or sub zero liquids at low pressure. Speeds up to 3600 R. P. M. Capacities 100 to 3,000 G. P. M., and differential pressures up to 325 P. S. I. It is one of the many types of high precision pumps designed and built by Pacific.*

In pump engineering, Pacific has always anticipated and met the requirements of industry with a long list of "Firsts" in design, and construction.



Two of the Dresser Industries

CLARK BROS. CO., INC.
OLEAN, N. Y.

PACIFIC PUMPS, INC.
HUNTINGTON PARK, CALIF.

Special Public Services

In addition to the basic program of the Foundation in research for advancement of the useful knowledge of science, every effort is made to obtain the maximum public service from the aggregate facilities. Thus it has been possible to contribute to the general public benefit in an increasing number of ways other than through the research projects.

National Registry of Rare Chemicals. Now firmly established as a necessary part of the scientific scene, in its third year of operation the National Registry of Rare Chemicals continues to serve the technical professions and industries throughout the world. The Armour Research Foundation, in maintaining this free public service, considers the success of the Registry due in a large measure to the unified cooperation of the major scientific societies, industries, and individual scientific workers everywhere. From laboratories and plants in the United States, South America, England, Australia, South Africa, India, Canada, and Mexico, have come over 3,400 requests for unusual compounds needed in research or production. As the central clearing house for information on the location and availability of rare chemicals, the registry has been able to fill approximately 75 per cent of these inquiries. The registry does not stock, buy, or sell chemicals, but merely serves as a locating agency and information source. Its files have grown to include sources for more than 8,000 rare chemicals not listed by regular suppliers.

Wire Recorder Program. One of the Foundation's contributions to a growing number of channels of public benefit is the service rendered through the magnetic wire sound recorder. Quite apart from its creation of postwar employment and its commercial aspects as a new industry, this recently developed recorder has provided an unexcelled opportunity for increased world enlightenment and for numerous other public aids.

Since the ultimate value of research is dependent upon its practical availability, the Foundation has established a new section to develop educational and industrial uses of wire sound recording. The fact that to date the recorder has been manufactured by a limited number of licensees for the exclusive use of the Armed Services has not necessarily kept its potential applications unknown in the postwar fields. These applications, to mention but a few, include: home recording in radio receiving sets; educational uses in schools, homes, industries, and illiterate world areas; professional records; office and remote dictation and transcription; police calls; transportation orders on land, sea, and air; remote pickup and broadcasting; court reporting; recording telephone messages; and amateur movies. During the past year the Foundation has continued its policy of licensing and instructing qualified manufacturers to produce magnetic wire sound recorders for use in various fields. Although actual production is entirely absorbed in the many wartime applications, this activity is being conducted simultaneously with a view toward postwar uses which will render the instrument of value to the maximum number. The fact is, of course, that while achievements in the engineering and manufacturing of recorders for the Armed Services can in some instances be converted to postwar industrial applications with reasonable promptness, certain other uses must await the conclusion of additional developments before widest use can be expected.

From the Foundation's new Chicago loop offices, opened May 31 for the correlation of these activities, a

COMING YOUR WAY

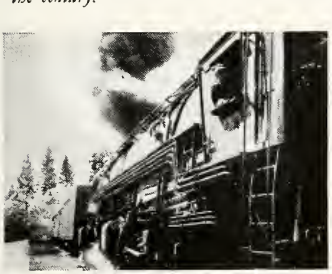
A New Kind of Horsepower is Changing Your World

This is the story of what is likely the biggest thing that has happened in our time . . . of a new kind of power spreading throughout the world . . . of a new force affecting our lives, our outlooks, and our incomes as perhaps only electricity has done since the turn of the century.

1. Under the wing of a giant Lockheed Constellation, in the shadow of one of the big ship's four Wright Cyclones, two men talk. One is a veteran airline pilot who lives and works in a world most people haven't yet begun to know or understand or even to imagine! The other, a man who has seen a whole vast western section of America change in his lifetime as if by magic!

2. The Westerner operates a ranch that was literally made possible by power — electricity and irrigation from the great Boulder Dam harnessing the Colorado River. Power which made possible the conversion of millions of acres of barren wilderness into fertile ranches and farms!

3. No wonder he's eager to hear the pilot tell of a new super-power — such as that of the Wright Cyclone . . . the engine which speeds the great Boeing B-29 Superfortress across the air miles to Tokyo . . . power that makes possible a trans-Atlantic flight every 13 minutes.



4. Most efficient power plant in the world, today's Wright Cyclone packs a horsepower into less than a pound of metal. Four Cyclones develop more power than the mightiest locomotive operating in the Rocky Mountains . . . and already this new power is changing ranches and farms, business and homes . . .

5. These Cyclones help make possible the operation of U. S. transport planes over more than 110,000 miles of global air routes. For example, 1,800 cargo shipments daily leave a single U. S. airport, and millions of miles are daily flown by U. S. airlines and the Air Commands of our armed services.

6. Carrying our men, materials, ideals to the corners of the earth — breaking down barriers of distance — the Cyclone power of American aviation is changing the world you live in . . . right over your head!

LOOK TO THE SKY, AMERICA!

CURTISS WRIGHT

AIRPLANES • ENGINES • PROPELLERS

[AVIATION OFFERS A BRIGHT FUTURE FOR COLLEGE ENGINEERS: WRITE ENGINEERING PERSONNEL BUREAU, CURTISS-WRIGHT CORPORATION, PASSAIC, N. J.]

limited number of recorders are being made available on loan for certain purposes which will effect meritorious public service and at the same time provide valuable field test data for study in particular applications.

Arrangements have been made for the United Nations Relief and Rehabilitation Administration to experiment with a recorder loaned to that organization for use by its Balkan Mission. At the outset, this recorder is being utilized successfully to disseminate mass instructions with respect to health and hygiene in camps sheltering more than 35,000 Jugoslav and Greek refugees.

In the east and midwest the U. S. Department of Agriculture, to whom a recorder has been loaned also, recently conducted a series of on-the-spot interviews at agricultural experiment stations which were later broadcast on several farm radio programs. These recordings, made in collaboration with state agricultural colleges and local radio station farm program directors, included such topics as corn pests, animal ailments, and farm developments and experiments, and avoided the necessity of having the speakers travel to the broadcasting studios.

The Library of Congress has an experimental machine which is expected to record on wire, for preservation, the hundreds of priceless disk records of American folklore music which have been made for the Library's archives. Most recently, the Library of Congress has added to its collection the historical records of the Battle of Saipan, originally recorded by one of the early wire recorders built by the Foundation. The Foundation was fortunate in obtaining this battle-scarred recorder, together with some spools of the Saipan wire records, which will probably be presented to some prominent museum following a series of requested exhibitions throughout the country.

The recorder's worth to the blind is being demonstrated through the loan of a machine to the American Foundation for the Blind. The Armour Research Foundation plans to collaborate extensively with organizations assisting the blind, in implementing the recorder for study courses and entertainment for the sightless.

A future highlight of the recorder's value in postwar times is the major part that it will play in educational projects in schools and colleges, as well as in connection with the program of radio education for adults now receiving such great emphasis. Groundwork is being laid through various educational channels to project the recorder's use in this direction. The U. S. Department of Education is now arranging educational FM networks for state educational systems, and the wire recorder will probably be used extensively by schools for playing back these programs at convenient hours in various classrooms. Similarly, such programs can be recorded at home for use in adult study courses.

Toward furtherance of these objectives, two new organizations are in the making. A proposed society of licensees for technical conferences is under discussion. Meanwhile, the Wire Recorder Development Corporation has already been granted a charter. The latter contemplates providing an educational record distribution service to sponsors of educational projects. It will work with wire and wire magazine manufacturers to bring about mechanical perfection, high standards of quality in the recording medium, low prices of blank wire magazines, and assurance of a convenient source of supply. These things are equally desirable in the interests of the general public, the machine makers, and the record makers.

City Noise Reduction. During the past year the Foundation has contin-

UNION CARBIDE *AGAIN* REPORTS

on the production of

BUTADIENE

for the Government's Synthetic Rubber Program

ONE OF THE MOST IMPORTANT factors in the Government's rubber program is the production of GR-S type synthetic rubber.

The basic chemical in this rubber is Butadiene, which can be made from alcohol or hydrocarbon materials.

The Government's original plan provided that about one third of the required Butadiene would be made by CARBIDE AND CARBON CHEMICALS CORPORATION'S alcohol process.

In 1943, their first year of operation, however, the plants using this process produced over 75 per cent of all Butadiene made for GR-S type synthetic rubber.

In 1944, the second year, these plants produced about 64 per cent of all Butadiene necessary for military and essential civilian rubber. This was true despite the fact that good progress had been made in the production of Butadiene by other processes.

THE RECORD

The first tank-car load of Butadiene was shipped from the Government's Carbide-built, Carbide-operated plant at Institute, West Virginia a little over two years ago.

This was just five months after the famous Baruch Committee Report pointed out this nation's desperate need for rubber—and approved Carbide's butadiene alcohol process, originally selected by Rubber Reserve Company, as one of the solutions.

In its first year the Institute plant, with a rated capacity of 30,000 tons per year, produced enough Butadiene for more than 90,000 long tons of synthetic rubber.

Two more great plants using Carbide's alcohol process—and built from the blueprints of the Institute plant—are in full production. One of these, with an annual rated capacity of 30,000 tons of Butadiene is located at Kobuta, Pennsylvania and is operated for the Government by another important chemical company.

The second, with a rated capacity of 60,000 tons a year, is operated for the Government by Carbide at Louisville, Kentucky—making the total rated capacity of the two huge plants now operated by Carbide 140,000 tons a year.

In 1944, the production of Butadiene from the three plants using the alcohol process totaled 361,000 tons—representing operation at over 164 per cent of rated capacity. An even higher rate is expected in 1945.

* * * * *

Before Pearl Harbor, the United States was a "have not" nation with respect to rubber. Now, thanks to American research, engineering and production skill, our country can take its place as a dominant factor among the great rubber producing nations of the world.

▼

Business men, technicians, teachers, and others are invited to send for the book P5 "Butadiene and Styrene for Buna S Synthetic Rubber from Grain Alcohol," which explains what these plants do, and what their place is in the Government's rubber program.

SEPTEMBER 10, 1942

"Of all the critical and strategic materials, rubber is the one which presents the greatest threat to the safety of our nation, and to the Allied Cause.... We find the situation to be so dangerous that unless corrective measures are taken immediately the country will face both a military and a civilian collapse."

—Report of the Rubber Survey Committee (Baruch Committee).

AUGUST 31, 1944

"Undoubtedly the outstanding achievement of your company has been the development of your process for the production of Butadiene from alcohol. With a rather meager background of experimental work, your engineers were able to design and construct commercial units for the production of Butadiene. In an exceedingly short time, the operation of this equipment at capacities up to 200 per cent of rating has been largely responsible for our present safe situation with respect to rubber supplies..."

—Letter from Rubber Director Bradley Dewey to CARBIDE AND CARBON CHEMICALS CORPORATION

The material herein has been reviewed and passed by the Rubber Reserve Company, the Defense Plant Corporation, and the War Department.

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ued to assist in the activities of the Greater Chicago Noise Reduction Council in reducing the unnecessary noises in the City of Chicago. Through the efforts of the Council and the City's Noise Abatement Commission, Chicago has been awarded the National Noise Abatement Council's plaque for the second consecutive year for outstanding work in noise abatement.

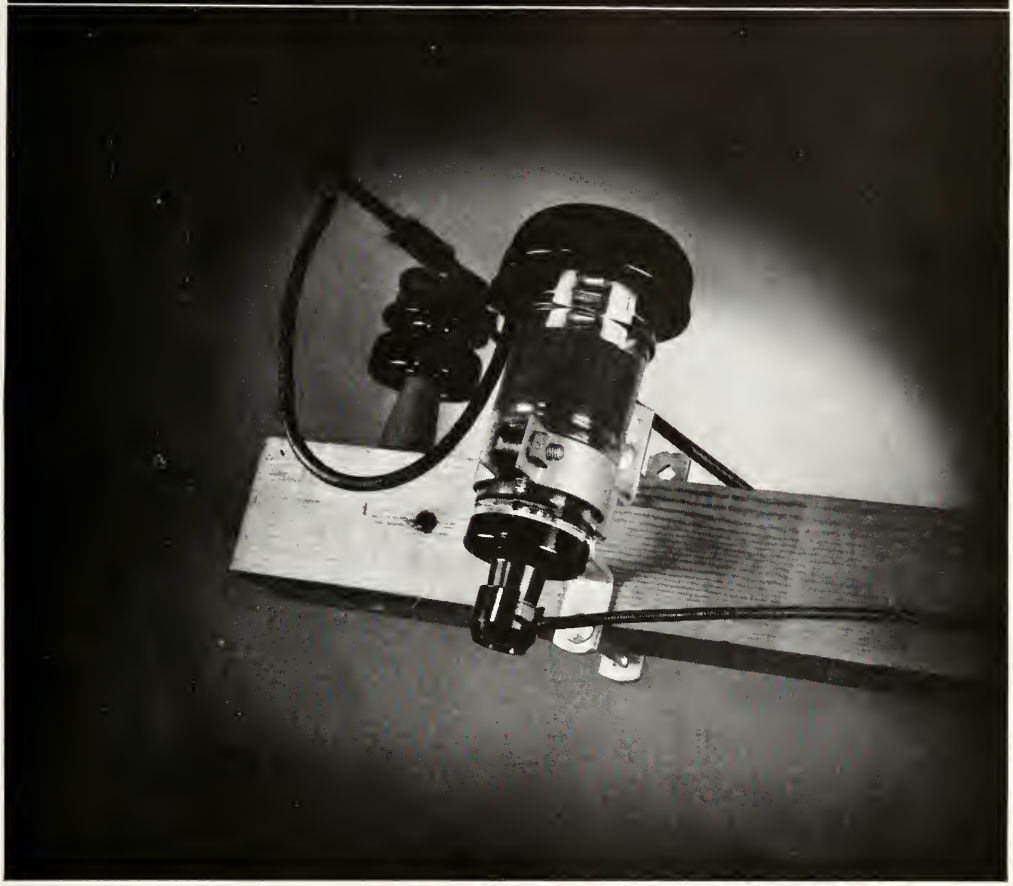
Radio Interference. As a national community contribution, two members of the Foundation's major Physics Research Staff have been made available for service on the Committee on Scientific Instruments for Panel Twelve of the Radio Technical Planning Board. This Committee, consisting of physicists from industry and scientific institutions, has been charged with making a study of possible interference with radio reception which might be caused by scientific instruments. Its findings, together with those of the other sections of the Radio Technical Planning Board, will make possible the best utilization of available radio channels.

Technical Advisory Services. The Foundation has continued to provide general technical advisory service on as broad a scale as possible. Inasmuch as certain types of technical activities are outside the scope of this organization, in a very large number of cases this service has consisted of referral of the inquiries to appropriate commercial testing laboratories or consultants. Meanwhile, in addition to sponsored long and short term research studies, the Foundation has been able to answer directly hundreds of inquiries, either supplying the necessary technical information or suggesting sources where it may be obtained. Many of these inquiries have come through the Smaller War Plants Corporation, while others have been received directly from manufacturers and individuals in the United States, Canada, Latin America, England, and elsewhere. The greatest use of this service is made by smaller manufacturers, whose technical inquiries are concerned chiefly with standard industrial practice, and who are sometimes unfamiliar with the numerous research, testing, and consulting facilities available to them generally.

Industrial Research Projects

Since the beginning of the fiscal year, 55 new long-term industrial or governmental research projects have been undertaken: abrasives, air conditioning, aluminum casting, automatic sprinkler control, boiler descaling, bolts, bushings, cathode ray tube

It tells lightning where to go...



REMEMBER in "the good old days" how often you were without electric power for hours after a severe electric storm?

Among the many reasons why you get almost uninterrupted service today is this glass gadget that looks like an over-size salt shaker. When lightning hits a line, the lightning arrester whisks the harmful jolt into the ground in a split second. And the line goes back to normal operation.

The lightning arrester body is built by Corning out of a special Corning-developed glass. It's tough, and it will change your opinion of glass if you always thought of it as a frail, brittle material. You'll find hundreds of such surprises at Corning today. Glass pumps, for example, and heavy glass fractionating columns for chemical industries. Airfield runway marker lenses capable of bearing the weight of a plane. Corrosion-resistant glass pipe for the food and other industries. These are just a few of the jobs that glass can do better than other materials, thanks to Corning's nearly 100 years of glass-making experience. Corning, like everybody else, is deep in war work today. But after the war keep your eye on *glass* as a new pioneering material for industry and on *Corning* as the outfit that knows glass. Corning Glass Works, Corning, N. Y.

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means
Research in Glass

screens, cellulose, chocolate, clays, copper welding, counting devices, crucibles, cutting oils, dental materials, Diesel engine indicators, dry corn milling, electrical networks, electroplating, engine conplings, gas turbine blades, glass fibers, flexible shafting, fountain pens, fuel additives, industrial process war aids, insecticide dispensers, lithography, magnetic recording wire, metal detection, mica beneficiation, milling survey, multiple recording, permanent molds, piston ring gage, potash, powdered metals, protective coatings, pumps, shade rollers, sound recorder production, stenographic devices, thermoconples, vacuum tubes, wall paper, waterproof fiber containers, wood, and seven projects whose titles cannot be disclosed for security reasons.

During the year 30 projects, including 24 carried over from the previous fiscal period and 6 initiated in 1944, were completed: alternating current motors, air cleaners, air injection, annealing, automatic sprinkler control, ceramic molds, cupola operation, electron optics, fanweed seed, gas turbine blades, gear wear, mica processing, milling survey, nonferrous melting, oil refinery equipment, permanent molds, powder metallurgy, railroad brakes, sound recording, steel converter operation, structural lumber, surgical sutures, tank tracks, welding, wire rope, and five in confidential fields.

A BEACH AT HOME

Westinghouse lamp engineers have succeeded in packing sunlight into a lamp that weighs only a few ounces, carries its own reflector, and can deliver a coat of tan three times faster than a hot July sun.

The new streamlined lamp functions as simply as a light bulb and can be screwed into any socket operating on a-c current. Five minutes under the lamp at a distance of two feet will give the average complexion a tan comparable to one acquired by 15 minutes on the beach in mid-summer.

A tiny bi-metallic switch and a tungsten filament inside the lamp replace a bulky transformer. Vaporized aluminum on the rear half of the bulb's interior acts as a reflector. An electric current passing mercury vapor produces ultraviolet rays.

Seven projects are under temporary suspension through the cooperation of their sponsors, to aid in meeting urgent military research needs: cigar lighters, computing machines, cranes, dynamic loading, golf equipment, pipe bends, and spraying equipment.

In all, 117 major research projects have been in operation during the year, exclusive of the 7 under suspension. Ninety-four projects continue into the coming year, including 49 of the new ones already listed, the 7 suspended, and 38 of from one to six years' duration. Those of the last-named group are: acoustic tube, airport loading, airport paving, boiler water conditioning, carbohydrates, cast valves, compressed gases, container glass, core binders, core boring, crane survey, die steel, dolomite, drum closures, electrical weighing, electronic gas analysis, electrotinning, engine lubricants, fibers, filters, gas containers, impact studies, magnesium forging, malting, metal finishing, noise reduction, open-hearth slags, quenching oils, silencers, steel casting, textiles, turntables, watch technology, welding supplies, wheat, wire drawing, and two on confidential subjects.

The grease monkeys that tickled Royalty!

Back in 1903, when you could still acquire a reputation as a wit by yelling "get a horse," a group of American auto mechanics really showed their English cousins, including some representatives of royalty, what mass production of interchangeable parts was all about.

They stripped three cars and threw the parts in a pile. Then they rebuilt the cars using stock parts, and they ran perfectly, much to the delight and surprise of the audience. Today thanks to the high accuracy of interchangeable parts, the marvel of mass production is commonplace. But few people stop to think how much mass production with accuracy owes to modern grinding methods, and modern abrasive products such as are made by "CARBORUNDUM."

Helping industry increase production and lower costs is one of the most satisfying of occupations. And that is the job of "CARBORUNDUM" Abrasive Engineers. If you would like to consider this form of engineering for your life work, please write The Carborundum Company, Niagara Falls, New York.

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JAZZ

(Continued from page 18)

"Death Ray Boogie." These four sides bring out Johnson's unique musical personality, and ought to be carefully studied.

Blue Note has also issued important Ammons and Johnson records: "Holler Stomp," "You Don't Know My Mind," which are Pete Johnson solos; "Kansas City Farewell" and "Barrelhouse Breakdown," by the Pete Johnson Blues Trio (with Ulysses Livingstone on the guitar and Abe Bolar on the bass); also the Albert Ammons solos, "Suitcase Blue," "Bass Goin' Crazy," and the sad and beautiful "Chicago in Mind."

Columbia Album C-44, "Boogie Woogie," contains a collection of masterpieces. There is Ammons playing solo in "Shout for Joy." There is Johnson Playing "Roll 'em Pete," with Joe Turner singing. There are two brilliant Harry James trumpet performances, "Boo Woo," accompanied by Eddie Dougherty, Johnny Williams, and Pete Johnson; and "Woo Woo," accompanied by Eddie Dougherty, Johnny Williams, and Albert Ammons. Finally, there is also in this album a THREE piano performance by Ammons, Johnson, and Meade "Lux" Lewis of "Boogie Woogie Prayer" (two sides).

Louis Armstrong pours the warmth of the Southland from his cornet.

When you have studied and thoroughly understood these records, you will be ready to go on to graduate school and a master's degree. Meanwhile, don't forget the field study and first-hand research at Cabin in the Sky.

James P. Johnson

It is said that James P. Johnson's style of piano-playing influenced the late Thomas "Fats" Waller. It is said that James P. Johnson, "lost" for many years, had to be "rediscovered." (Just as Meade "Lux" Lewis had to be rediscovered, washing cars in a Chicago garage, almost ten years after his recording of "Honky Tonk Train Blues" had made him famous. Society is like a child; its attention is easily distracted; it forgets and loses its favorites, then it whoops with joy when they are found again.)

Whatever else they may say about James P. Johnson, I know nothing about it. I only know that he plays the piano, and he plays it well. For the past three weeks I have been listening during my moments of leisure to four magnificent 12-inch records of piano solos by James P. Johnson—and I've been having a whale of a good time.

Mule Walk Stomp

These are the records, issued by Blue Note: "J. P. Boogie" and "Gut Stomp"; "Black Water Blues" and "Carolina Balmoral"; "Improvisations, on Pine Top's Boogie Woogie" and "Caprice Rag"; "Mule Walk Stomp" and "Arkansas Blues" (Blue Note, Nos. 24, 25, 26 and 27).

"Carolina Balmoral" and "Caprice Rag" are both extremely rapid pieces, calling for a light and fast touch. Like early New Orleans ragtime classics, they are highly reminiscent of

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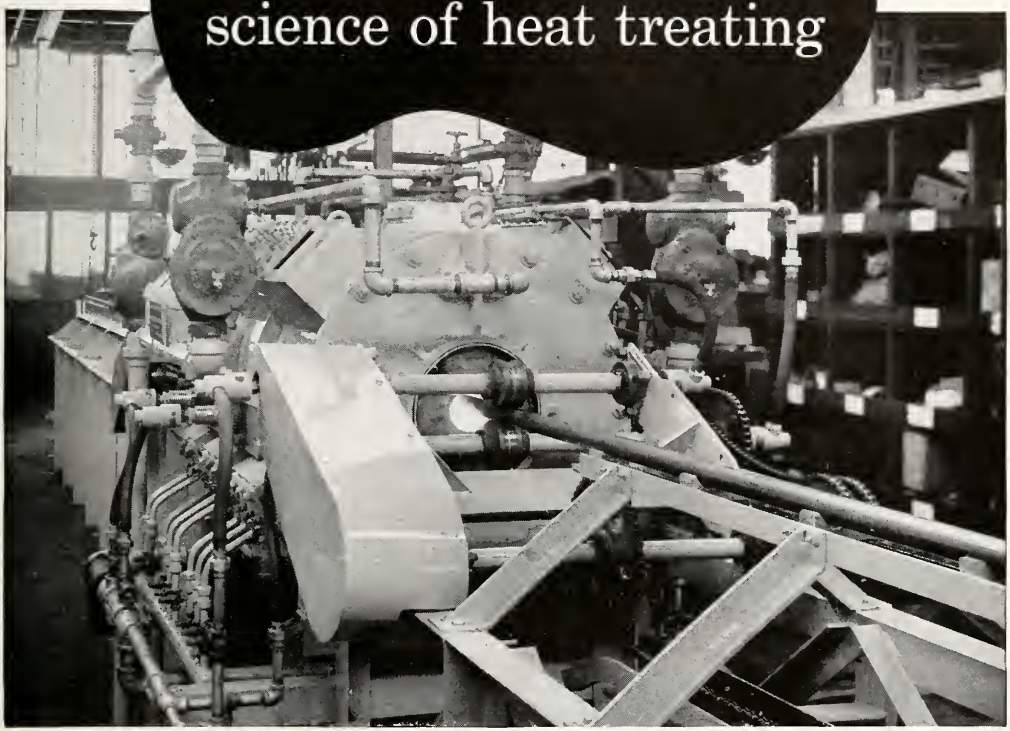
How Gas advances the science of heat treating



Gas-fired rod annealing furnace; photo courtesy of Selas Corporation of America

Research in Gas application, through the ceaseless study and experiment of equipment manufacturers, independent laboratories and the facilities of the American Gas Association, is constantly producing improvements and new departures in the application of heat, industrially.

For example, heat treating of metal rods in batch furnaces has certain disadvantages, particularly that of uneven heating throughout the bundle of rods. A group of engineers recently perfected a continuous-flow type Gas-fired furnace with a ceramic heating unit capable of intense, focussed heat, and closely fitted to the shape of the work in progress.

There are many advantages to this new Gas technique for annealing. For instance, one inch rod stock passing through a six foot furnace of the new type can be heated and quenched at a rate of 12 feet per minute, no section of the metal remaining under heat more than thirty seconds—against 2½ hours in a batch furnace. Furthermore, better uniformity of heating is achieved; scaling, distortion, decarburization are minimized. Floor space of the new furnace is 24 square feet against several hundred feet for the older type. Over-all costs are also considerably reduced.

Local Gas Companies help make these new benefits of Gas and Gas Equipment available to industry through the services of skilled Industrial Gas Engineers, who are available for consultation without obligation.

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French and other European dances. They probably belong, in their original inspiration, to the period in New Orleans in the eighties and nineties when Negro musicians, picking up tunes while serving at white social affairs, brought them home to lick into shape in their own way. At least that's the way they sound to me except that as James P. Johnson plays them, much of the original grace of the quadrille has been restored (at triple speed!) at the same time as they are played in "hot" fashion.

Two in Boogie Style

"J. P. Boogie" gets going in the first couple of choruses with what is probably the trickiest boogie bass figure I have ever heard. It slithers around like a slightly punch-drunk garter snake. Then, just at about the point when you decide you don't care where that darned snake is going next, Johnson stops the funny business and settles down to that grim insistency with the left hand (umbadada, umbadada, umbada, umbadada) that is pure boogie. Meanwhile, of course, the right hand is having a high time wandering whimsically all over the place—which again is pure boogie.

It's hard to pick our favorites in a group like this, but if some mean fate were to ordain that three of these four records had to be broken, I believe I would save to the last Johnson's playing of "Arkansas Blues." No, I wouldn't either. Maybe I'd better save "Back Water Blues." I dunno. Maybe I'd better dicker with fate and ask her to spare me two records. Better still, maybe I'd better tell her just to go and not bother me or my records any more.

Edmond Hall's Jazz Men

While I am on the subject of Blue Note records, there are two more of the same label that I have recently acquired to my profound gratification. They are No. 28, with "High Society" on one side, and "Blues at Blue Note" on the other; and No. 29, with "Royal Garden Blues" and "Night Shift Blues." These are played by a beautifully well-coordinated group of instrumentalists, Edmond Hall's Blue Note Jazz Men; with Edmond Hall on the clarinet; Sidney De Paris, trumpet; Vic Dickinson, trombone; James P. Johnson, piano; Arthur Shirley, guitar; Israel Crosby, bass; and Sidney Catlett on the drums.

"Night Shift" and "Blues at Blue Note" are new compositions, both of them haunting, melancholy, and deep blue. In the former, Crosby on the bass and Shirley on the guitar are sensational, while the dirty work on

LET'S GET THE ADMIRAL HIS HORSE!

Official U. S. Navy Photo

Admiral Halsey has his eye on a fine white horse called Shirayuki.

Some time ago, at a press conference, he expressed the hope that one day soon he could ride it.

The chap *now* in Shirayuki's saddle is Japan's Emperor—Hirohito.

He is the ruler of as arrogant, treacherous, and vicious a bunch of would-be despots as this earth has ever seen.

The kind of arrogance shown by Tojo—who was going to dictate peace from the White House . . . remember?

Well, it's high time we finished this whole business. High time we got the Emperor off his high horse, and gave Admiral Halsey his ride.

The best way for us at home to have a hand in this clean-up is to support the 7th War Loan.

It's the biggest loan yet. It's two loans in one. Last year, by this time, you had been asked twice to buy extra bonds.

Your personal quota is big—bigger than ever before. So big you may feel you can't afford it.

But we *can* afford it—if American sons, brothers, husbands can cheerfully afford to die.

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200-210	112.50	150
180-200	93.75	125
140-180	75.00	100
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This is an official U.S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council

the trumpet by De Paris and on the clarinet by Hall in "Blue Note" is so good as to be positively upsetting. Those great jazz classics, "Royal Gardens" and "High Society" are played with all the magnificent vehemence of spirit that they demand. They will remind you of your early youth—and leave you plumb wore out.

Louis Armstrong King of Jazz

If anything in jazz history can be dignified by the term classic, Louis Armstrong's early records with his Hot Five and Hot Seven are perhaps the most deserving of that honor. ("Yes, sir, classic with a capital K," said Langston Hughes' Simple Minded Friend to me. I ran into him the other day and when he tried to borrow two bucks from me I couldn't think of a better way of changing the subject than bringing up Louis Armstrong. It worked fine.)

How I envy the people who used to hear Louis at the Vendome theater! William Russell, writing in "Jazzmen" (edited by Frederick Ramsay and Charles Edward Smith; Harcourt, Brace, $3.50), has described the performance:

"At a typical Vendome show one first heard a standard overture interpreted with musical freshness by Erskine Tate's Little Symphony orchestra. Then Louis, all smiles, climbed out of the pit and hopped on the stage, toting his cornet in one hand and his indispensable handkerchief in the other. Instantly the house was in an uproar, feet stamping on the floor, cheers and whistles rending the air.

"A few preliminary flourishes of the handkerchief and Louis was off on his feature number, "Heebie Jeebies." Before he hit the second note they were swaying back and forth in their seats all the way to the last row. He kept that up for a while and as suddenly picked up a little megaphone and in a husky voice poured forth the words of the song with all the warmth of the Southland.

"He took another vocal chorus, not with words but with a guttural mouthing of incoherent nonsense, supplemented with unearthly grimaces. This hair-raising hokum had about it a chilling fascination, all the more be-

cause the steady beat helped to create a background for Armstrong's rhythm which itself added to the suspense."

"Twelfth Street Rag"

The nearest we can come now to recapturing the magnificence of those performances is I suppose, to listen to the recently re-issued Louis Armstrong Columbia album (Hot Jazz Classics, C-28) which contains in addition to other equally exciting records (the "Heebie Jeebies," with the "husky voice," with the "guttural mouthing of incoherent nonsense") ("Deet, da, deetliyapa-da; doopa-doopa woodliyoopa, da, wa") indeed, with everything except the unearthly grimaces and the flourishing of his handkerchief.

"Twelfth Street Rag," in the same album is almost a textbook of what to do with a small combination when you've got a handful of brilliant instrumentalists. The first few bars give the flavor of a march, reminding you at the beginning that this all comes from New Orleans. Then comes Louis soloing with his trumpet, exclamatory, fluid, and vivid; at one time teetering perilously among the high notes; sometimes dropping behind a quarter of a beat, sometimes a whole beat, and then suddenly rushing up to catch up with himself; throwing out ideas as generously as if they were counterfeit bills, except that his aren't counterfeit.

Then the sudden and dramatic entry of Kid Ory's trombone, even-tempered, self-assured, cultivated, and loud. He gives out with a "dirty" tone occasionally, but not too dirty (i.e., considerably short of filthy). Then the whole orchestra helps in negotiating the transition into the next phase which is Johnny Dodds' clarinet.

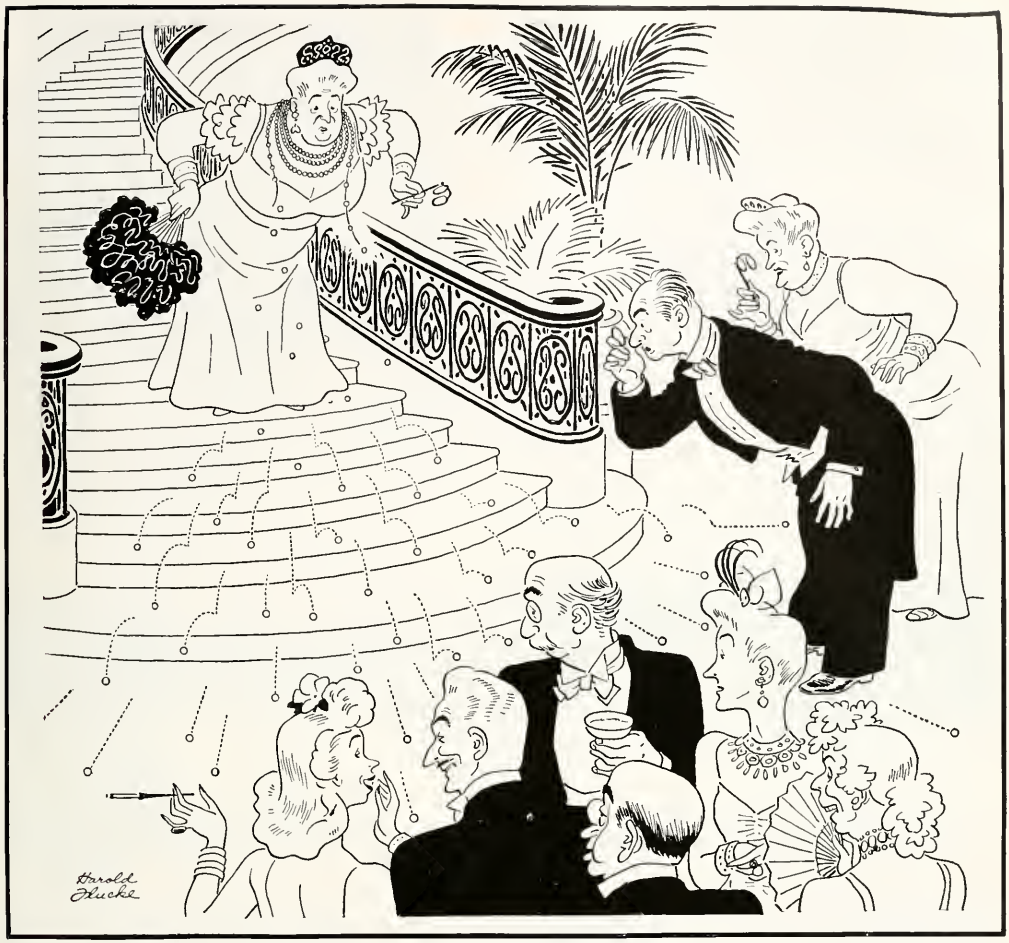
Chicago's Great Days

Johnny Dodds' discography occupies almost two whole columns in "Esquire's 1945 Jazz Book," and I haven't heard many of the records listed. But if one-tenth of them are as exciting as his solo in "Twelfth Street Rag," which is car-piercing and astonishingly lyrical at once, then a very sensible program for a hot jazz enthusiast would be to start trying to build a complete Dodds collection. (That, incidentally, is the thing about jazz: it can be screaming and lyrical, growly and tender, mean and sweet, tragic and happy, all at once. It combines contradictories. It defies logic.)

Then at the end of the record the whole orchestra lets go, returning from a thousand miles away in Chicago's South Side to the vividly and nostalgically remembered New Orleans street parade. The entire performance is something to hear again and again.

The remaining selections in Album C-28 are "Knockin' a Jug," "Potato Head Blues," "Squeeze Me," "No One Else But You," "Save It Pretty Mama," and "S.O.L. Blues." And if you find these exciting, you ought to continue with Columbia Album C-73, featuring in addition to Armstrong the magnificent piano work of Earl Hines, in such classic selections as "Monday Date," "Chicago Breakdown," "Muggles," and "Tight Like This." "West End Blues," also in this album, is justly regarded by many of the hot cognoscenti as the greatest jazz record of all time.

All these performances mean a lot to me, but I cannot help thinking how much more they must mean to those who remember not only the Vendome, but also the Sunset Cafe, the Dreamland, and Plantation, and the eight-page music supplement to the *Chicago Defender* in 1926 when Richard M. Jones arranged the huge bene-orchestras.



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We Face a Famine of Scientists

Although the United Nations have forced Germany's capitulation and are making impressive gains against Japan, we shall never know how much more quickly our triumph would have come had we from the outset recognized the vital importance of technology in this war. We still draft young technological experts into the armed services, which do not need them, and thereby take them from war industry, which needs five times as many as are available. Perhaps this is not the sole reason why Germany came up with the first robot bombs and the first rockets, but that fact is something for the greatest industrial producer in the world to contemplate in humility when mapping out future policy.

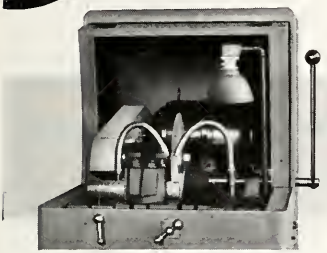
As we face the enormous task of converting our war industries into peace industries—and into jobs for millions of people now employed in war plants—it may be a good idea to face some of the facts which we have shoved to one side during the war. First, it will be impossible to produce 60,000,000 jobs or anything like that figure either by pouring out the taxpayers' money or by telling business and industry to produce jobs or the Government will produce them. The only way to make jobs is to make available for peace needs the technical advances which have been made in the war. Development of transportation, from the horse and buggy to the airplane, with the collateral boom in petroleum, rubber, steel, electrical devices and curb service, was not accomplished by speeches about guaranteeing jobs. It was accomplished by the hard work of thousands of technologists who were permitted to experiment and dabble and try out their hunches. As the result of our selective-service policy, we face a real shortage of technical men for a new technical era. We expect miracles to be performed by "science," but forget that the job—which is no miracle—has to be done by scientists.

The fight to retain technologists in positions where their efforts would be useful has not been waged by the technologists themselves. The skilled men below thirty—who virtually monopolize the new knowledge on which leadership in war depends—have been silent. They have had to be. The fight had to be led by older men who understood the importance of technology in war. As one of the leaders in the fight puts it, "If technologists were like some other groups, they would just keep quiet and let the supply of technologists run as low as possible. Then the law of supply and demand would boost their pay to the skies. A mere handful of technologists in about ten years solved the problem of quick-freezing foods. Now the results are applied in hundreds of centers with less highly trained specialists or laymen able to carry on. The man who did the most in this development is no longer in the field. He is seeking new problems to solve. not for the financial reward, but because technologists are made that way." Because the chemist is not much of a squawker in his own behalf, we have ignored his right to be heard.

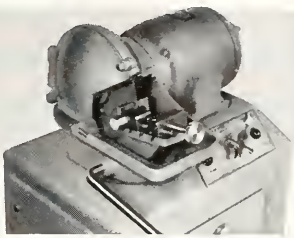
Consequently, more than 15,000 chemists and chemical engineers are found in the armed services doing work having no relation to their training. At the same time we have damned up the supply of new technicians who would normally be entering technical schools and colleges. A bill has been introduced in Congress making it possible to undo some of the damage by relieving a few of the chemists from K.P. duty and scrubbing decks, and sending them back to industry, and by permitting a limited number of boys to take technical training. This appears to be about the least that must be done if we are to avoid a disastrous shortage of trained scientists in an age which every five minutes we describe as "scientific."—(*Reprinted by special permission of the Saturday Evening Post, Copyright,* 1945, *by the Curtis Publishing Company.*)

Buehler SPECIMEN PREPARATION EQUIPMENT AND SUPPLIES FOR THE METALLURGICAL LABORATORY

The items illustrated are selected from the complete Buehler line of equipment, tools and accessories for molding and finishing specimen mounts.



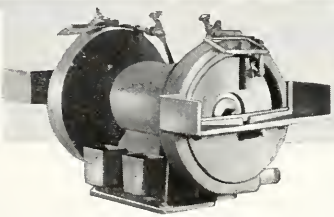
Abrasive Cut-off Machine, Model No. 1000, is a solidly built, heavy duty piece of equipment free from sideplay or vibration with capacity for cutting specimen sections up to 3-1/2". Cutting is done on the front of the wheel and is controlled by a convenient outside lever. The driving motor is a totally enclosed ball bearing, 3 hp. with a separate motor driving the self-contained cooling system. Overall dimensions of cabinet 31" x 47" x 64". Shipping weight, 1400 lbs.



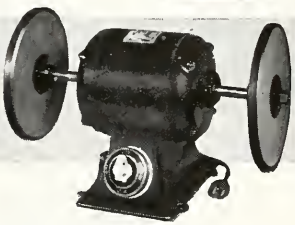
Model No. 1010, a 1 hp. Cut-off Machine with cutting wheel mounted directly on motor shaft. Motor is ball bearing completely enclosed with sufficient power for fast cutting of samples up to 1" diameter. Overall dimensions 24" x 28" x 50". Shipping weight, 575 lbs.

Specimen Mount Press No. 1315 has complete accessibility, no enclosed parts. Smooth performance permits speed and accuracy in operation. Solid heater can be raised and the cooling blocks swing into position without releasing pressure on the mold. This rapid cooling permits production of transoptic mounts in a few minutes. Shipping weight, 100 lbs.

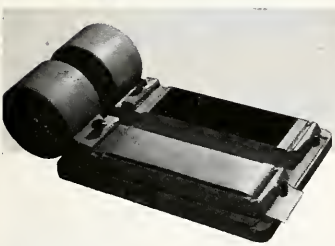
Heavy Duty Wet Power Grinder No. 1215, for coarse and medium coarse grinding. The entire surface of the 12" wheel is exposed for grinding; thus providing a wide range of grinding speeds. A self-contained recirculating cooling system supplies a soluble oil coolant independently to each wheel. A feature of this machine is its freedom from vibration. Shipping weight, 435 lbs.



Wet Power Grinder No. 1210, powered with a 3/4 hp. totally enclosed ball bearing motor has two 12" water cooled wheels fitted with closed-in guards and non-shatterable shields. Suitable for coarse and medium grinding. Shipping weight, 310 lbs.



Emery Paper Disc Grinder No. 1400, motor shaft is extended to provide four grinding surfaces for four grades of emery paper. Emery paper discs 8" diameter are held in place by a convenient two-piece clamp. Motor is 1/3 hp. with two speeds, 575 and 1150 r.p.m. Shipping weight, 75 lbs.



Hand Grinder No. 1410 is a most conveniently arranged two stage grinder. The grinding surfaces are 4-1/2" x 12-1/4" each with heavy 7/16" thick plate glass back. A reserve roll of 150 feet of emery paper is contained in drums for quick renewal of grinding surface. Base has gutter drains for surplus liquid in wet grinding operations. Shipping weight, 95 lbs.

Standard Polisher No. 1500. A complete unit with direct mounted 1/4 hp. radial thrust ball bearing motor. The 8" polishing disc is attached to a tapered arbor on the motor shaft by means of a stout sleeve. This sturdy construction and unusually smooth vibrationless operation helps to prevent pitting and amorphous film in polishing. The removable splash ring forms a convenient hand rest that aids the operator in precision work. A handy control lever on the mounted switch gives selective speeds of 575 and 1150 r.p.m. Shipping weight, 100 lbs.

Low Speed Polisher No. 1505-2, is particularly adapted to final stage polishing and for non-ferrous metal samples. The 8" disc is attached to a countershaft by a tapered sleeve with a long span between bearings, a construction feature that assures smooth operation. The selective speeds of 150 and 250 r.p.m. make this polisher perfectly adapted to the wax lap or lead lap polishing technique. Shipping weight, 105 lbs.

Either the standard or low speed polishers can be furnished in a single unit table model polisher No. 1516. A three unit table model No. 1540 is also available for maximum convenience in three stage polishing.

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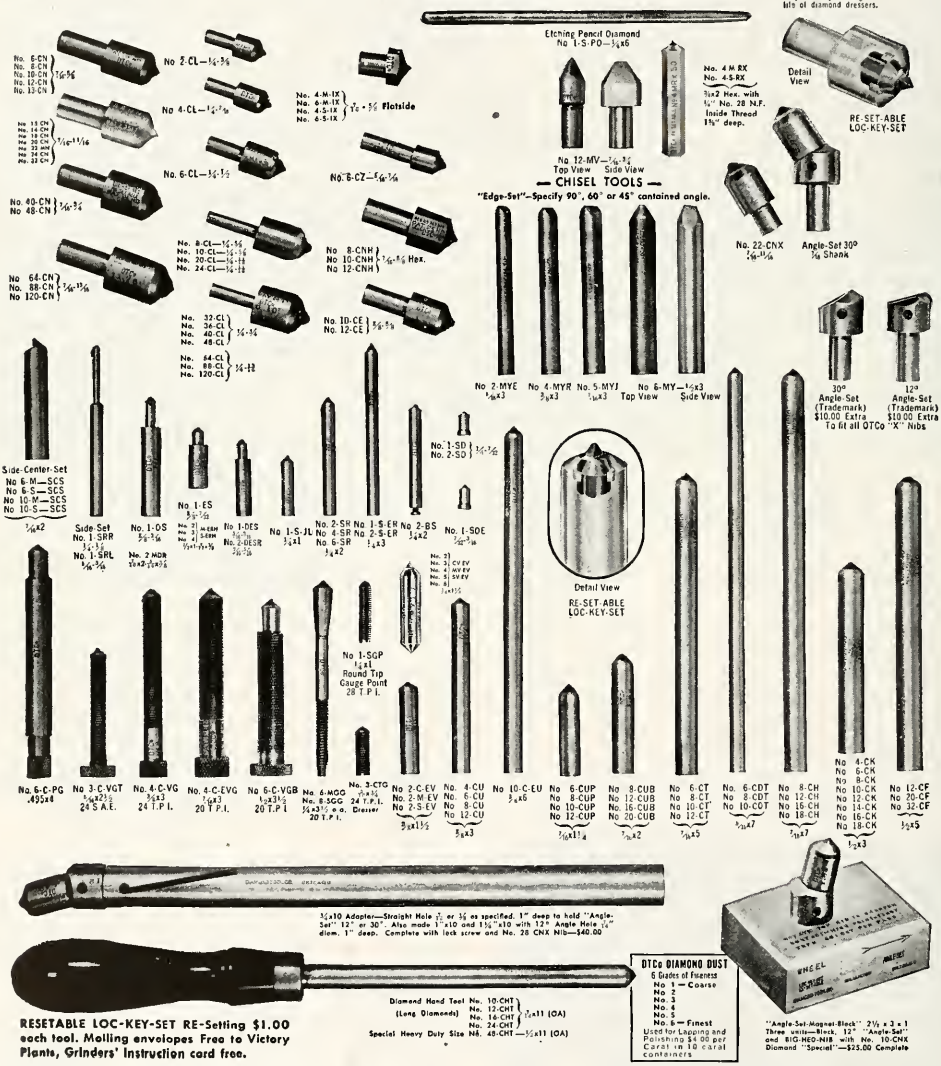

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INSTRUCTIONS FOR ORDERING: Number of each tool pictured is eight times the diamond size contained in tool, and is two times the diameter of grinding wheel each tool is suited for. Example—For ½ carat number of tool is 4, and it is suitable for 2-inch diameter wheel; for 3 carats number is 24, suitable for 12-inch diameter wheel. NOTE: Above recommended sizes are for heavy production and include an added 50% safety allowance. For light work add ½ diameter to recommended wheel size. Diamond weights are stamped on all tools where space permits. Form Tool Diamonds: Special tools made from customers' prints and specifications. Reprints of this presentation furnished on request.

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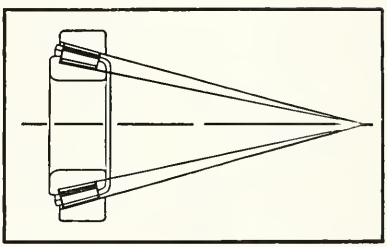

FIGURE 1

1. TRUE ROLLING MOTION

This basic necessity is assured by making all lines coincident with the tapered surfaces of the rollers, cup and cone, meet at a common apex on the axis of the bearing, Figure 1. True rolling motion always has been incorporated in the Timken Bearing.

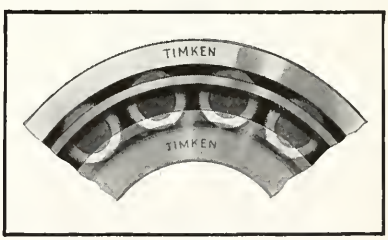

FIGURE 2

2. POSITIVE ROLLER ALIGNMENT

During the development of the Timken Bearing, as speed, load and accuracy requirements increased, various methods were used to stabilize the rollers and prevent them skewing in the raceways. The solution was found in establishing wide-area contact between the large ends of the rollers and the undercut rib of the cone, thus assuring constant and accurate roller alignment around the periphery of the raceways. The light areas on the ends of the rollers in Figure 2, show contact of rollers with undercut rib of cone.

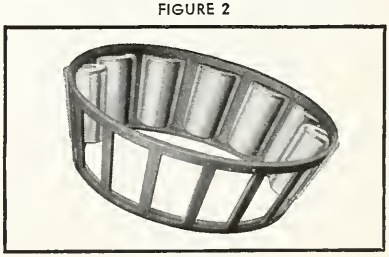

FIGURE 3

3. MULTIPLE PERFORATED CAGE

All the openings in the Timken Bearing cage, Figure 3, are stamped out in one operation by means of multiple perforating dies made to extremely close precision tolerances. This assures exact center-to-center spacing of the rollers around the periphery of the raceways, so that every roller takes its full share of the load when the bearing is in operation.

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